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PUBLIC HEALTH.

REPORT

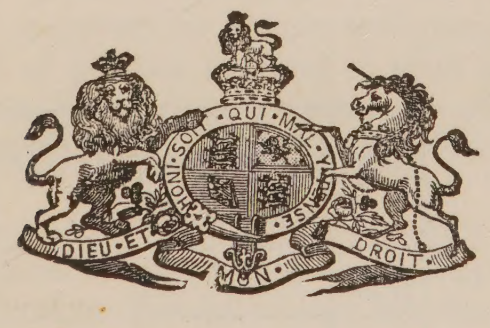
OF

THE MEDICAL OFFICER OF THE PRIVY COUNCIL,

WITH APPENDIX.

1858.

Presented to both Houses of Parliament by Command of Her Majesty.



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1859.

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REPORT.

MY LORDS, Privy Council Office, Whitehall; 1859.

IN obedience to the Public Health Act, 1858, which provides that the Medical Officer of the Privy Council "shall, in or "before the month of March in each year, report to the Privy "Council the proceedings had and taken under this Act, during "the preceding year ending on the 31st day of December," and "shall from time to time report to the Privy Council in relation "to any matters concerning the public health, or such matters as "may be referred to him for that purpose," I now beg to have the honour of submitting to your Lordships my first Annual Report. Before entering upon which, it seems proper to mention that the Act under which I report came into operation only on the 1st of September last, when two-thirds of the year had already passed; and that, consequently, in reporting what was done under the Act in the year 1858, I have to speak only of what was done during the last four months of the year.

A.—Proceedings taken, during the year 1858, under the Public Health Act of that year.

The ordinary * responsibilities imposed on the Privy Council, under the Public Health Act, 1858, were the following:—

1) from time to time to issue regulations "for securing the due "qualification of persons thereafter to be contracted with by "guardians and overseers of unions and parishes in England for "the vaccination of persons resident in such unions and parishes, "and for securing the efficient performance of vaccination by the "persons already or thereafter to be contracted with as afore-"said;"—

2) to direct the application of "any money from time to time "voted by Parliament for or towards defraying the expenses of "the National Vaccine Establishment, or otherwise providing for "the supply of Vaccine Lymph;"—

3) to "cause to be made such inquiries as they see fit in "relation to any matters concerning the public health in any

* In times of "formidable epidemic, endemic, or contagious disease," present or threatening, the provisions of the Diseases Prevention Act, 1854, may be brought into force by an Order in Council; whereupon, under the Public Health Act, 1858, the Privy Council becomes responsible for issuing directions and regulations "for the speedy "interment of the dead, for house-to-house visitation, for the dispensing of medicines, "guarding against the spread of disease, and affording to persons afflicted by or "threatened with such epidemic, endemic, or contagious diseases such remedial aid and "accommodation as may be required."

" place or places, and to the observance of the regulations and " directions issued by them under the Act."

The proceedings taken under the Act may, therefore, conveniently be considered under these three heads.

I.—As regards the Regulation of Public Vaccination.

Having been desired by your Lordships to prepare a draft of such regulations as might, in my opinion, fulfil the objects of the law, I gave most careful study to this subject, taking pains also to possess myself of the views of other members of my profession who had given it special consideration; and before the close of the year, I had the honour of submitting my draft for your Lordships' consideration.

In 1858 no regulation was issued. But it may perhaps be permitted me to mention that recently a regulation* has been issued in reference to the *general* professional qualifications of persons in future to be contracted with; also that with the circular letter which communicated this regulation to local authorities throughout the country, there was forwarded a set of technical Instructions (Appendix No. 1) which your Lordships were of opinion should be observed by Public Vaccinators in the discharge of their contract.

With a view to arrangements for ensuring the sufficient *special* qualification of persons hereafter to be contracted with, communications have been held with the President of the Medical Council, the President of the Royal College of Physicians, and the President of the Royal College of Surgeons; the last-mentioned two of whom are also members of the National Vaccine Board. From these communications it appeared that the object would be facilitated, if the College of Surgeons would consent to require from each candidate for the diploma of the College the production of a certificate, to be given, in every large town where there is a medical school, by some public vaccinator, who, for this purpose, should be selected and supervised by the National Vaccine Board, and whose certificate should testify that the candi-

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* The regulation, dated March 14, was as follows: — " Whereas by the Public " Health Act, 1858, it is enacted that the Privy Council may from time to time issue " such regulations as they think fit for securing the due qualification of all persons, to " be thereafter contracted with by Guardians and Overseers of Unions and Parishes in " England for the Vaccination of persons resident in such Unions and Parishes.

" Now, therefore, it is hereby ordered, by the Lords and others of Her Majesty's " most Honourable Privy Council (of whom the Right Honourable Charles Bowyer " Adderley, Vice-President of the Committee of the said Privy Council on Education, " is one), that from and after the 25th instant, no contract for Vaccination shall be " entered into by such Guardians or Overseers, except with a Medical Practitioner " who shall be legally competent to practise both medicine and surgery in England and " Wales. Provided, that if in any union or parish it shall not be practicable for the " guardians or overseers, as the case may be, to contract with a person residing in or " near to the district for which he shall be required to act, fully qualified as aforesaid, " the guardians or overseers may report the circumstances to the Poor Law Board, and " the said Board may permit a contract to be entered into with a medical practitioner, " not fully qualified, for so long a time as the said Board shall deem proper."

date had practically studied vaccination and its results. A letter recently received from the Royal College of Surgeons announces that the College is ready to take its proposed part in this arrangement.

II.—As regards the National Vaccine Establishment and the Supply of Vaccine Lymph.

The short period during which the National Vaccine Establishment has been subject to the supervision of the Privy Council has to it been one of special importance; for within this time its directors have found themselves obliged, with your Lordships' sanction and assistance, to begin an essential change in what, for 50 years, had been the uniform practice of the institution.

It may be convenient to your Lordships that, before describing the nature of this change, I give an outline of the objects, constitution, and recent history of the establishment.

The original "object of establishing the National Vaccine Institution (as declared in Parliament in 1808, by those who promoted its first institution) was to forward the general adoption of vaccination throughout the empire, by giving to the practice the public countenance and support of Government. To most persons of intelligence the results of experience, both at home and abroad, appeared, even at that time, decisive of the great advantages of vaccination; but whether or no it were infallible, as a preventive of small-pox, was a question still involved in uncertainty. In order, therefore, to ascertain with precision the facts by which those doubts might be dispelled, to conduct such investigations under the eye of the public, and to insure accuracy to the publication of the results when ascertained, it was proposed that all cases of reputed failure should be referred to the Board. The Board were also to organize and set in action a central institution, for carrying on in London, under their own immediate superintendence, the practice of vaccination, and for distributing vaccine lymph to every part of the empire."* Of these objects there are several with which, in the course of time, it became unnecessary that the National Vaccine Establishment should occupy itself; and for more than twenty years the usefulness of the establishment has been restricted to the very important function of maintaining for general use, and distributing as wanted, a supply of trustworthy vaccine lymph. Its proceedings for this purpose have been directed by a Board, which, in the first eighteen years of its existence (1808–26) was composed of eight medical members; in the next six years (1826–32) of five; and in the following twenty-five years (1833–57) of three,—the president and senior censor of the Royal College of Physicians, and the president of the Royal College of Surgeons. With these eminent functionaries of my profession, I have for the last year, at the desire of Her Majesty's Government,

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* Report from the Select Committee on the Vaccine Board, ordered by the House of Commons to be printed, 28th August 1833.

had the honour of being associated in the direction of the establishment.

The proceedings of the Establishment, briefly described, have been these:—Gratuitous vaccination has been performed by it at several special stations in the metropolis; each stational vaccinator has contributed to the central office as many charges of lymph as he could obtain from subjects vaccinated by him; and the central office has distributed these charges gratuitously to all proper applicants.

Such for many years, on a very extensive scale, has been the action of the National Vaccine Establishment; and last year nearly 234,000 charges of lymph were distributed by the Board among 12,418 applicants. Constantly among the applicants are persons who, except for the existence of a central office, would be at a loss how to obtain what they desire; and application is often made under circumstances of emergency, when small-pox is at hand, and when waste of time would be a serious evil. Evidently, then, it is of essential importance that the sources of supply on which the central office depends for its means of meeting the public demand should be placed beyond any probability of failure.

These sources, up to the present year, had consisted exclusively in the special stations of the establishment itself. But of late it had been observed, and the observation was cause for much anxiety, that year by year those stations were becoming less and less resorted to for vaccination, and consequently less and less to be relied on for fulfilling the main object of their existence.

This gradual decline in the number of vaccinations performed by the National Vaccine Establishment depended altogether on causes exterior to the administration: it had resulted from successive changes in the law.

For more than thirty years after the establishment of the National Vaccine Institution, there existed in all England no other legalized local arrangements for public vaccination. Such other gratuitous vaccination as there was, depended on personal goodwill or on the action of charitable institutions. Even an overseer, it was said, was "not bound to take means to procure "the poor children of the parish to be vaccinated during the "prevalence of small-pox." And under these circumstances, the stations of the Vaccine Establishment existing in the metropolis were an important boon to the public, and were of course considerably resorted to.

Nineteen years ago, the Legislature first provided (3 & 4 Vict. c. 29) that vaccination at the public cost might be claimed of local authorities in every parish of England and Wales; and this enactment was soon followed by a fuller provision (necessary because poor-law guardians and overseers were to be the administrators of the law) that gratuitous vaccination should not place its recipient in the position of persons receiving parochial relief. In 1853 this system received further extension by the passing of the Compulsory Vaccination Act; under which it became an

obligation on parents and guardians, that in future all children, their health permitting, should be vaccinated within, at furthest, four months from birth. And although of course it was not in the letter of this law that peculiarly the parochial vaccinations should be increased by it, yet, from accidental circumstances which I need not now trouble your Lordships to consider, such in effect has been its operation.

These successive Acts of Parliament, in creating and developing the system of parochial vaccination, necessarily reduced the number of applicants at the National Vaccine Establishment. In 1838, the number of vaccinations performed by the establishment amounted to 18,659 ; during the three years 1850–2, the average annual number was only 10,713; during the three years 1854–6, it had fallen to 8,207 ; and last year it reached but 6,445.*

It will be obvious to your Lordships that, if the primary object of the National Vaccine Establishment had been to provide public vaccination, there was now no reason why it should continue to exist. But, in fact, its performance of public vaccination had no other meaning or importance than that the establishment might thus be enabled to fulfil what had become its one essential function—the function of maintaining and distributing a supply of authenticated vaccine lymph. And this duty had become of even increased importance; for, with the minute subdivision of vaccination-districts, and with other unfortunate accidents of the new system, it appeared certain that local supplies of lymph would, generally speaking, not be maintained long in an efficient state, and consequently that well-organized central arrangements for the collection and distribution of lymph were absolutely indispensable to the country.

The subject, too, was of somewhat urgent importance; not simply because the National Vaccine Establishment was currently distributing more lymph than in 1838, when its vaccinations were nearly thrice as numerous as of late; but because experience suggested that, in case of any great stimulus being given to public vaccination (such as was given in 1853 by the Compulsory Vaccination Act, and such as, it was hoped, might be more uniformly given under the Public Health Act, 1858) the average demand for lymph might suddenly rise 50 per cent.—attaining an amount which the Board, with its reduced and inelastic resources, could not undertake to supply.

It therefore became necessary to consider what plan could be adopted to compensate for the advancing diminution of those sources of lymph on which the public had heretofore depended for supply.

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* To this reduced number of vaccinations, seventeen different stations in the Metropolis contributed in unequal proportion: two of them together effecting 3,502 vaccinations, or considerably more than half of the total; while the remaining fifteen contributed various numbers, varying respectively from 72 to 373. At some of these fifteen stations vaccination was offered to the public twice, at others three times a week ; but from an analysis of their statistics, it appeared that the average number of cases vaccinated at each of them on each vaccinating day was only about $1\frac{1}{2}$.

Only one course, it appeared, was open. As the original sources of supply were becoming extinct through the competition of the new system of parochial vaccination, so the question arose, whether, in this new system itself, there could not be found a compensation for what was lost. For, generally speaking, it would seem self-evident, that the common supply of lymph in a country ought to be founded on the common provisions for public vaccination; that arrangements for the two purposes are essentially parts of one system; and that sources of lymph-supply disconnected from the national plan of vaccination could hardly be expected to have permanence.

Now, it was certain that at the parochial vaccinating-stations of large towns there must often exist abundant and eligible sources of lymph; but it was equally certain that those stations could not indiscriminately be utilised for the purpose of a national supply.

In the first place, well-frequented stations could alone be thus available. In order to keep up a mere succession of normal vaccine vesicles at any single station, it is requisite that vaccinated subjects returning for eighth-day inspection should habitually be numerous enough for ample selection to be exercised among them as to the taking of lymph; and much more, of course, is this necessary, if the succession is to be so abundant as to furnish an excess of lymph in aid of other vaccinating-stations. England contains dozens of large towns which might reasonably be expected to contain stations of sufficient magnitude for the purpose; but in many of these instances (and important metropolitan parishes are cases in point) the public vaccination is parcelled out among so many vaccinators, that perhaps not one station can conveniently be looked to for lymph. Again, very strict scrupulousness—almost fastidiousness, in everything which concerns the performance of vaccination and the watching of its results, must be claimed from persons who would supply lymph for the public service; for any mischief herein resulting from slovenly practice may not only be irremediable in some one particular case, but may ramify injurious results among large numbers of sufferers.

Obviously, then, the national supply of lymph could not properly be made even partly contingent on parochial contributions, unless with the understanding that each contributing-station should in the first instance be carefully chosen, with reference both to its resources and to the qualifications of its vaccinator, and should afterwards be vigilantly superintended with reference to its proceedings and results. Subject, however, to these conditions, it appeared not only that this course was admissible, but that in fact no other course in the present state of the law would enable your Lordships to ensure a sufficient supply of lymph for meeting the requirements of the public.

In a report, addressed in 1857 to the President of the then General Board of Health, I had drawn attention to the impending necessity, that some such arrangement should be made; and now, as a member of the National Vaccine Board, I felt it especially

my duty to bring before my colleagues (whose solicitude had already* been awakened on the subject) the considerations which I have submitted to your Lordships. Great advantage had been anticipated to the public service from the fact that, through the present constitution and relations of the National Vaccine Board, the Privy Council would have ready means of consulting, in reference to vaccination, with the heads of the two great Colleges of Medicine and Surgery; and, in the present case, that expected advantage was fully realised by the long and careful consideration which my distinguished colleagues gave to the subject. The result of the deliberation was a Minute of the Board, communicated to your Lordships on Nov. 17th; a copy of which minute, as an important proceeding under the Act, is appended (App. No. 2) to this Report.

The minute, after recounting the principal facts which had been under consideration, and specially adverting to the sources of lymph which are to be found at the parochial vaccinating-stations of Manchester, Liverpool, Birmingham, Leeds, Sheffield, Newcastle, and other large towns, made the following conditional proposal:—"that if the Board of the National Vaccine Establishment were satisfied that the public vaccinators of those stations would uniformly exercise proper care in the selection of lymph for transmission, the Board would be prepared to discontinue its own less productive stations, and to recommend the procuring of lymph from parochial vaccinators at the stations referred to."

The Privy Council, with its present regulative and inspectional powers in reference to public vaccination, could give every reasonable security for the fulfilment of the condition here stated as necessary; and the minute having expressed the hopes of the Board that the Lords of the Council would be pleased to direct such inquiries as were needful for the object in view, your Lordships acceded to this request.

Inquiry was accordingly made into the state of public vaccination in Manchester and Liverpool; and, as the practical result of this inquiry, arrangements have since been made under which the largest vaccinating-station of Manchester has become contributory to the lymph-supply of the National Vaccine Establishment. At the station in question, Mr. Evan Thomas, one of the Medical Officers of the Union, performs nearly 1,800 vaccinations in the year; and it is believed that, when the difficulties of a commencement are overcome, some twenty to thirty thousand charges of lymph may annually be furnished from this one source.

In two respects the step which has been taken seems to be of great importance. In the first place, as opening a communication —though hitherto only at one point—between the National Vaccine Establishment and the staff of parochial vaccinators, it begins to

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* The President of the College of Physicians, who is President of the Vaccine Board, had already, on the part of the Board, before it came under the direction of the Privy Council, waited upon Her Majesty's Secretary of State for the Home Department, to express the hopes of the Board that Government would take measures to prevent the anticipated scarcity of lymph.

combine as one system the arrangements for public vaccination with the hitherto separate arrangements for the supply of vaccine lymph; and thus to give to the latter arrangements a securer basis than they for many years have had. In the second place, it makes a commencement towards what may hereafter, with much advantage to the public, fill a present want in medical education. For hitherto it has been the case, that neither the ordinary schools of medicine have had means of practically teaching vaccination, nor have any of the public vaccinating-stations been opened as public schools for the purpose. Consequently many a medical student has completed his studies without having had any convenient opportunity of learning to vaccinate; and although the mere manipulation with the lancet scarcely requires special study, yet to know well the results of vaccination, especially to know well and practically the characters of a vesicle from which it is proper to take lymph, does require some little attentive and accurate observation. It has therefore often been wished that some well-frequented vaccinating-stations, situated in those large towns where medical schools exist, could be available for educational purposes. To connect such stations with the National Vaccine Board by making them superintended contributories of lymph (as is now done in the case of Manchester) is a first step towards giving them that special position and guaranteed character which would suggest their being recognized as national schools of vaccination.

III.—As regards Local Inquiries relative to the Prevalence and Prevention of Disease.

Under circumstances which I shall directly detail, it was your Lordships' pleasure to order inquiry to be made "in relation to "matters concerning the public health" in *Conway*, *Wraysbury*, and *Windsor*.

Other inquiries (not exclusively local) have been ordered by your Lordships, with a view of collecting for public and professional use information in reference to *diphtheria;* a disease which, of late, has been exciting great apprehension, and causing many deaths in various parts of the country.

Inquiry also has been made, with the Registrar-General's assistance, into the distribution of fatal diseases in England, and into the working of the Vaccination Extension Act, 1853. Some less general matters have likewise been inquired into by correspondence.

1. *Conway.*

On September 16th your Lordships received, through the Home Office, letters written by Major the Honourable W. E. Fitzmaurice, late M.P. for Bucks, alleging that "a most fearful and "malignant disease had broken out in the Town of Conway, "North Wales, and the neighbouring parish of Gyffyn; . . that the "whole of this had been long seen approaching, and the authorities "have had ample warning, but nothing will move them; . . that "the whole town is one nest of pigsties, and the town drains have

" been allowed for years to empty themselves into a small marsh " just outside the town gate, until the effluvium from it is something " perfectly pestilential." And in reference to the alleged inaction of the local authorities, the writer continued:—" My belief is, " that it arises solely from their being tenants under landlords " upon whose land or premises these nuisances exist, and they " are, therefore, afraid to act. I also know that the cottagers " are compelled to keep pig manure for months close to their " dwellings in the town, because the agents of these landlords " will make them keep pigs for the sake of the manure, and will " only cart it away at their own convenience, and, in one instance, " while four deaths occurred in one house, there was a heap of " pig manure half the height of the window within a yard of it, " and yet they will not take warning. If the cottagers made " any complaint of this or gave evidence, they would get notice " the next day! There are many houses in Conway without " any convenience whatever, and the inhabitants are compelled to " make use of the public streets in the most disgusting way, " especially the children; but the most deadly of all these nur- " series of pestilence is the land called the Morfa-bach, which is a " mass of undrained corruption, close to the town, and running " the whole length of the south side of it. I made a formal " written complaint to the local authorities in February last, and " nothing but a most inefficient attempt has been made to remove " the evil, and hence this fearful outbreak, which is now spreading " all over the country." Major Fitzmaurice's complaints having been communicated to the local authority under the Nuisances' Removal Act, that body replied to the following effect:—" We " find, upon inquiry, that scarlet fever has been prevalent in " several of the parishes comprised in the district of the Conway " Union (comprising fifteen parishes) as well as in other parts " of North Wales; and we have heard of as many as four " children having died in one house in a parish, which is about " ten miles distant from Conway. . . . It is not true that we are " afraid to act, and are ready to act whenever a proper complaint " of a nuisance has been or may be presented to us. With regard " to the small marsh mentioned in the Major's letter . . . we " beg to say that a considerable sum of money has been expended, " with a view of removing any supposed cause of nuisance."

From the local inquiry, which under these circumstances was made into the facts of the case, it appeared,—first, that the particular disease, to the prevalence of which in Conway your Lordships' attention had been drawn, could not reasonably be imputed to official mismanagement in the town; but, secondly, that the laws for the protection of the public health were in Conway most inefficiently administered; and that, although the disease actually in question had no immediate dependence on this official neglect, yet probably other disease was being thus engendered in Conway, and serious outbreaks of diarrhœa, cholera, or typhoid fever might at any moment arise in a town where cleanliness was so much neglected.

The Morfa-bach, complained of by Major Fitzmaurice, was formerly the bed of a little stream, which now is partially diverted from its course: it is a marshy ground, nearly half a mile in length, liable to frequent floodings by the tide and by freshes; it is situate almost immediately under the walls of the town, where it divides the parishes of Conway and Gyffyn. Till recently a sewer had discharged on to this surface, producing the filthy swamp written of by Major Fitzmaurice; but this sewer was now prolonged to the sea, and works had been commenced (though hitherto little advanced) by the joint action of the parish authorities, the directors of the adjoining railway, and the proprietor of the soil, to effect the general drainage of the marsh.

But still more, within the walls of the town, nuisances existed to a flagrant and dangerous extent:—nuisances arising from the absence of privy-accommodation for the labouring classes; nuisances arising from the absence of proper arrangements for the removal of house-refuse; nuisances arising from the imperfect and offensive state both of the public sewers, where they existed, and of the drains and sinks of yards about inhabited premises; nuisances arising from the unregulated existence of various offensive trades—tanning, skin-dealing, slaughtering, bone-selling; nuisances arising from the very extensive keeping of pigs, and from the great accumulation of their refuse within the inhabited area. The dwellings of the poor, sometimes as being ruinous, sometimes as being ill adapted for ventilation, and very generally as being without proper privy-accommodation, required amendment. Often, too, these dwellings held more inhabitants, than, even with good ventilation and cleanliness, would have been desirable; and in some cases they were much overcrowded. The well-water within the town, owing to the close proximity of the wells to various sources of contamination, was not such as could properly or safely be drunk; and although there are public fountains within the town, supplied from exterior sources, it appeared that sufficient care had not been taken to preserve even that supply from pollution.

In a town where there is scarcely any house-drainage, where privy-accommodation is largely deficient, and where pigs are most extensively kept, it is more than commonly needful that good arrangements should exist, for the frequent and facile removal of refuse from private premises; and it may easily be conceived how great an amount of nuisance must have been occasioned in Conway, by such a state of things as the following description details:—

"Although there is an arrangement for cleansing the public "streets, which seems to be tolerably efficient, the scavenging of "the houses and private premises is most deficient, and has not "hitherto been at all regulated by the authorities. Dust and "manure heaps, and ordure are allowed to accumulate in the "small yards behind the common description of houses, and in "every unoccupied corner throughout the town, until of sufficient "size to realize a good profit by their removal. It was repre-"sented that such nuisances are sometimes allowed to accumulate

" for a year or more, before they are removed; and it was " repeatedly stated by the cottagers that the manure is not " removed from their yards oftener than twice, or at the oftenest " thrice, in the year. This noxious custom is partly due to the " want of supervision by the authorities, partly to the desire of " the people themselves to accumulate a saleable quantity prior " to its removal, but chiefly to the fact that certain farmers claim " the privilege of removing the manure from particular premises. " It is a significant circumstance that the farmer who obtains the " largest proportion of the manure of Conway is likewise the " agent of one of the largest properties; and, although there is no " legal compulsion, it is pretty well understood that he must have " the manure at a fixed price; and hence it is apt to be left on the " premises for a very long period. . . . The cesspools, dust-holes, " and dung-hills, which are met with in all the yards, and where " there are no yards, in odd corners near the houses, are uncovered " and freely exposed to the air; and the smell from them is often " evident within doors. There is rarely any back entrance, so " that all the soil and manure must be conveyed through the " houses at the periodical cleansing of the ashpits and privies."

Bad as was the state of the town, it was said to be much better than a few years back; and, little before the time of the inquiry, the local authority under the Nuisances Removal Act (consisting in this case of the guardians and overseers of the poor, and the surveyors of the highways) had issued notices for the abatement of various nuisances. From what has already been stated, it is obvious that those notices had produced little effect.

Conway enjoys some advantages of construction, which have made it possible for this uncleansed state of the town to exist with comparative impunity. Not only is there enough irregularity of surface, to prevent the walls of the town from much interrupting the out-door circulation of air; but the streets and houses are remarkably intermingled with open spaces, sometimes of waste ground, sometimes of garden, so that the population is not densely aggregated, and the nuisances are diluted with abundant ventilation.

I have stated that the disease to which your Lordships' attention was called could not properly be imputed to the state of the town. It was, as the local authority had alleged, scarlatina. It had prevailed in the rural neighbourhood of Conway for months before the town was affected; and investigation of details, both within and without the town, did not show either that the disease had been comparatively absent from the better-conditioned dwellings, or that its more fatal visitations had belonged with any marked preponderance to the worse-conditioned dwellings.*

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* To interpret these facts it is necessary to remember a familiar, but important, distinction which was insisted on in my last year's report on the Preventability of certain kinds of Premature Death. The common infectious diseases of childhood—the "diseases " which occur to most persons once in life," cannot, during the present state of knowledge on the subject, be spoken of as products of local uncleanliness, or, without exaggeration, have the word *preventable* applied to them in the sense in which it is applied to typhoid fever, and to epidemic or endemic diarrhœal diseases. The former

Still, in other respects, it does not appear that Conway has altogether escaped from the ordinary consequences of filth. Examination of the mortuary statistics of the sub-district in which Conway is situated—apparently one of the healthiest in England, shows, for that half of the population which dwells within the town, a markedly higher death-rate than for that other half which dwells in the adjoining rural parishes; and "low fever," though not of a fatal kind, appeared disproportionately frequent in the book of the parochial medical officer.

I refrain from insisting on these points, because the statistics are necessarily on a small scale (the entire sub-district population not amounting to 3,500) and very minute sources of fallacy might therefore affect their value. In objecting to the extreme uncleanliness of Conway it seemed sufficient to rest on the general principle, that, during this state, accidental circumstances could easily develop an amount of dangerous illness far beyond the common experience of the town.

On October 29th, your Lordships' views of the above facts were communicated to the local authority at Conway, with a recommendation that effectual means should be taken to enforce the provisions of the law.

Information has since been received that a Nuisance Removal Committee has been appointed; and it is to be hoped that this body may be more successful than the former local authority, in enforcing a decent state of cleanliness in the town. This object is the more desirable, as the population of Conway seems tending to increase, and with greater density would be much more liable than heretofore to the dangers of an opposite course.

2. *Wraysbury.*

On September 21, through the Local Government Act Office, your Lordships received a memorial, signed by the vicar, churchwardens, overseers and guardians of the poor, and surveyors of highways, with other ratepayers of the parish of Wraysbury, in the Colnbrook division of the poor law union of Eton,

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diseases, whenever called into existence (and among us, now, they never cease to exist) appear to have their distribution essentially determined by the intercourse of infected with susceptible persons. Crowding and imperfect ventilation (such as are common in the houses of the poor, and by no means entirely absent from the houses even of the rich) directly favor this process of contagion; the same and probably other sanitary faults render the resulting infections generally more fatal to life than they would be under opposite conditions; perhaps even they augment the susceptibility to contagion; but it does not appear that any hitherto-attained excellence of common sanitary circumstances ensures a marked immunity from the affections referred to, or even an entire escape from their severe and fatal forms. Nothing is yet certainly known with respect to the primary source of measles, scarlatina, small-pox, and hooping-cough. On analogy, it is quite conceivable that they may first have arisen in the world from peculiar conditions of domestic filth, and that similar specific conditions may now from time to time originate new outbreaks. But these suppositions are not yet established as facts in science; and only in proportion as they are probable can it be hoped that common sanitary improvements, which will certainly banish some other diseases, will also destroy the sources of those ordinary dangers of childhood. With confidence, however, it may be anticipated that, under the influence of such improvements, those diseases, though their sources be not extinguished, will become greatly less destructive of life among persons who contract their contagion.

Bucks, declaring that the memorialists "feel serious alarm at the "increase of small-pox of a most malignant description in this "parish;" which disease, they believe, "originated from the use "of infected and unwholesome rags in paper mills in the neigh- "bourhood;" and (several deaths having occurred) the memorialists "earnestly beg to call your immediate attention to this urgent "matter."

The facts of the case were accordingly, by your Lordships' directions, made matter of local inquiry.

Evidence, carefully collected in Wraysbury and its neighbourhood, did not establish, as proven, the belief of the memorialists that the small-pox, which for six months had existed in the union had arisen by contagion from rags used in the paper-factories; though some of the facts elicited were of a kind to account for that suspicion having been entertained.

Two months before the beginning of undoubted small-pox, a girl, aged 18, employed in the Poyle mill, at Colnbrook, had an illness which kept her from work about a fortnight, but did not lead to her being seen by any medical man. This illness began with sickness, headache, and pain in the limbs (but not in the back) on the day next succeeding one on which she had been engaged in cutting up some very offensive rags in the mill. About a week afterwards she had a few spots on one arm, "which she picked, and they went away"—leaving no mark. This case was not at the time imagined to be small-pox; but apparently the earliest undoubted case of small-pox in Colnbrook (and probably in the neighbourhood) was that of a younger sister of this girl. Suspicions thereupon arose, that the illness of the elder must have been small-pox; that she had contracted it by contagion in the mill; and that the younger (a child aged 8, not employed in the mill) having caught it from her, had directly or indirectly infected other inhabitants of Colnbrook, Wraysbury, and the neighbourhood.

After the lapse of six months, it was not possible completely to prove or disprove these suspicions. If the facts were exactly as stated, probably the original disease was not small-pox; for, on the one hand, the alleged symptoms were not characteristic of this disease; and, on the other hand, the alleged interval of two months between the respective illnesses of the younger and elder sister was four time as long as that which commonly separates any two cases of small-pox, where one has been infected from the other. But assertions as to facts of this kind are singularly difficult to verify; and it seems to me not possible, in the present case, to say that the suspicions are absolutely disproved.

Some other considerations, however, deserve notice.

The memorialists may properly deprecate the employment of infectious rags in paper-factories within their district, as a source of danger to the work-people, and through them, to the neighbourhood. But, as regards the disease now in question, there are sources of danger quite independent of paper-factories. Too often by other ways, in the common chances of traffic, the contagion of

small-pox is brought into the vicinity of susceptible persons; and the safety of any population against this dreadful disease must mainly depend, not on the accidental absence of its contagion from among them, but on the degree in which they have chosen to protect themselves by general, timely, and efficient vaccination.

In the whole Eton Union (within which Wraysbury is situated) there was apparently great insufficiency of vaccination. For the year and three-quarters last preceding the inquiry the numbers of registered infantine vaccinations was considerably less than half the number of registered births; and the facilities for public vaccination afforded by the local authorities were, in some respects, not satisfactory. It was certain that numbers of unprotected persons were among the infected population; and that, unless they were duly vaccinated, small-pox might continue in the district till all such persons had suffered from it.

It was, therefore, under your Lordships' directions, recommended to the local authorities, that every exertion should at once be used to effect, as quickly as possible, the vaccination of all unprotected persons in the district, and that gratuitous re-vaccination should be offered to persons between puberty and advanced age, who had not been vaccinated since infancy.

It was also suggested to the board of guardians that, at their earliest convenience, the ordinary local arrangements for public vaccination should undergo revision;—first, with the view of giving greater facilities for vaccination to those parishes * from which the vaccinating-stations of the union were considerably distant; and secondly, with the view of arranging the public vaccinations in such a manner as might most easily enable the vaccinators to maintain for themselves an independent supply of lymph.

3. *Windsor.*

On November 26th, representations were made to the Lord President by Sir James Clark, Physician to the Queen, that typhoid fever was prevailing epidemically at Windsor, that great anxiety was excited by it, and that, in his opinion, inquiry ought to be made into the causes of the epidemic. This investigation was accordingly ordered.

Primâ facie there was reason to suspect that the origin of the disease was connected with some failure in the general drainage of Windsor; and as I could not pretend to offer any skilled opinion either on the causes of such failure, or on the engineering remedies best suited for their removal, your Lordships, on my submitting this consideration, were pleased to request from Her Majesty's Secretary of State for the Home Department that the assistance of the Local Government Act Office might be given for that part of the inquiry. This request obtained me the valuable co-operation of Mr. Austin, superintending inspector of the office.

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* The vaccination station for the parish of Wraysbury, for instance, was at Colnbrook, three miles distant from Wraysbury.

Whenever, therefore, in the following remarks on the epidemic of Windsor, I make any statement relative to the sewerage or house-drainage of the town, your Lordships will understand that I speak on the authority of Mr. Austin, whose report hereto appended (App. No. 3.) will enable your Lordships to judge whether the town council of Windsor, as the local board of health, and the authority for carrying into effect the provisions of the Nuisances Removal Act, has efficiently exercised those large powers with which the Legislature has entrusted it.

First, however, as to the nature and extent of the epidemic—I have to report, that inquiry fully justified the allegations which had led your Lordships to order it. The disease was one of those common filth-fevers which occasion in England and Wales annually about 18,000 preventable deaths. Specially, too, as alleged, it was fever of that particular kind (the typhoid or intestinal) which, in respect of its causes, has most affinity with cholera and diarrhœa; being a disease peculiarly apt to occur whenever any population breathes an atmosphere, or drinks a water, polluted by the decomposition of human excrement.

It was, as alleged, epidemic in Windsor, and was exciting much alarm. It was impossible to learn with even an approach to accuracy how many persons had suffered from the fever. During the last quarter of the year 26 deaths from it were registered in Windsor; and some more had occurred at a distance, in servants and others, who, having contracted the disease in Windsor, had been sent away sick by their employers. The number of attacks was estimated at more than 400;—an estimate, no doubt, greatly in excess of the number of cases of true typhoid fever, but probably not in excess of the number of persons who, either in that way or in other kindred ways, suffered from the action of the fever-producing cause. Even this large number appeared larger than it was; for it happened that almost simultaneously with the typhoid fever there was prevailing an epidemic of scarlatina; and in non-medical estimates of the sanitary condition of Windsor, these diseases were apt to be confounded as "the fever." The typhoid fever in Windsor was prevalent among all classes of the population; not (as too commonly happens with such preventable diseases) pressing disproportionately on the poor.

As regards the causation of the disease in this particular instance, nothing was easier than to see that in Windsor, generally, there was extreme slovenliness as to the removal of filth. In parts of the town common nuisances abounded;—offensive pigsties, unregulated slaughter-houses, heaps of unremoved refuse, or puddles of obstructed surface-drainage; and where there were street-inlets to sewers, stenches were loudly complained of. Though a local company was pumping reasonably good water from the Thames, three-fifths of the houses were not supplied from this source, but obtained their water from surface-wells; which, sunken within a populously inhabited area, sometimes in proximity to undrained premises, and sometimes almost in contact with imperfect drains, could not but be regarded as generally objec-

tionable, and, in some instances, very dangerous sources of supply.

No medical observer would be surprised, under such circumstances, to find many scattered or grouped cases of typhoid fever or other diarrhœal disease. But in Windsor (according to Mr. Austin's report on the sewers) there was operating an influence beyond these which I have named—an influence which existed almost generally through the town; and to this, I think, it must have been due, that the fever prevailed so extensively as a general epidemic among the population. For Mr. Austin describes one specific fault, as having pervaded the whole sewerage of the town; and this was a fault which affected the sewerage just in its most important relations to the dwellings of the people. Systematically, he says, it was without adequate exterior ventilation; and therefore systematically, he infers, it must have ventilated itself into the houses which communicated with it; "completely nullifying the "advantages which would otherwise have resulted from the excel- "lent plan of works which had been carried out. Certain "openings from the public sewers" (says Mr. Austin) "have "been made in the streets; but the principal ventilation should "have been provided in the construction of the house-drains; "either by special pipes carried up outside buildings where con- "venient, or by means of the rain-water pipes where they could "be safely used for the purpose. The gases generated in the "sewers have a tendency to rise to the higher parts, and especially, "collect in the house drains; and where they have no other "means of escape, these pent up and undiluted gases necessarily "have their discharge at the sinks or other inlets to the drains "within and about the houses themselves. Even, where the traps "are perfect, this escape of foul air will take place from these "openings every time water is discharged into them, but the "traps, themselves, I found to be frequently imperfect, and the "bell traps of the sinks often loose, so as to favour the continuous "admission of foul air to the houses."

Last autumn, by the accidental concurrence of a long-continued drought, these evils were enabled to inflict more than common injury on the population. Mr. Austin describes the sewerage of Windsor as having been made to a great degree dependent on certain supplemental flushing arrangements, "the low-level line "being so laid out as to admit of a continuous flow of water "through them from the Thames; other lines being provided at "their heads with flushing tanks, supplied from the waterworks;" and the effects of last summer's remarkable drought are stated by him in these terms:—"There has been a diminished current of water "flowing through the low-level sewers. The same reason has "reduced the power of raising the supply of water from the town, "and there was very frequent complaint of its deficiency. The "water not being laid on at all to many houses, constant flushing "operations would be imperatively demanded, but the arrange- "ments provided for this purpose appear to have been employed "only once a month. I found evidence of considerable deposit

" taking place in the sewers between these intervals, and of much " foul smell arising from it when distributed."

To sum the case in a few words:—*the system of sewerage at Windsor, with frequent domestic defects of sink-trapping, favoured the habitual escape of sewer-atmosphere into houses; last year, from accidental circumstances, the sewer-atmosphere was at about its maximum of poisonousness; and the result was an epidemic of typhoid fever.*

There were striking illustrations that the epidemic spread according to the continuity of that atmosphere. One dense grouping of cases took place in the neighbourhood of the outfall sewer, in a low-lying, but somewhat open, district, occupied by modern middle-class houses. And in this district, though " com- " plete house drainage had been generally carried out, and water " laid on to the sinks in the houses," yet, says Mr. Austin, " I found " considerable evidence of the general prevalence of bad smells at " certain times...When the wind is in the east, it blows up the main " outfall sewer, and forces the foul gases generated in the town " sewers and house drains of this immediate locality into the " houses through the water-closets and sinks, and into the streets " through the gullies. This forcible movement of the air in the " sewers would have been of no consequence whatever, and would " not have been perceptible to the inhabitants, had there been any " upper external openings from the drainage works at which any " foul air could have had continuous and gradual escape; but in " the absence of such provision the inhabitants are exposed to this " noxious influence in a concentrated and dangerous form." A second remarkable aggregation of cases took place in the high-level district, among the best class of houses in the town; where, says Mr. Austin, " house drainage has been completely carried out " with water-closets usually within the houses, and sinks in the " basements and kitchens. As the sewage would flow down to " lower levels, the tendency of the foul air disturbed would be to " flow upwards, as before stated, and escaping at all such inlets " within and about the houses in the absence of proper venti- " lating shafts, those who would be most exposed to this noxious " influence would naturally be most likely to suffer from whatever " evil consequences might arise from it."

At least equally remarkable with the attacks, were the local exemptions from the epidemic. Surprise was expressed at the almost entire immunity of one considerable low-lying and poor district, formerly ravaged by cholera, and still accounted the worst part of Windsor. But in this district, whatever may have been its other defects, the inhabitants were little exposed to direct exhalations from sewers; for generally here, says Mr. Austin, " there are no sinks or other openings from the drains within the " houses themselves. With two exceptions, I found no complaint " of smell from the sewers of this neighbourhood. One woman, " whose child had died of fever, complained bitterly of constant " smell from the gully immediately opposite to her door, and " another woman complained of the smell from a gully opposite " to her house, whenever the sewers were flushed."

A second exemption on a large scale was, happily, that Windsor Castle; and here again the exemption is intelligible. For the drainage of the Castle, said Mr. Austin, is "abundantly "ventilated and appears to be scrupulously kept in working order; "it is quite distinct from the town sewers, and apparently "quite safe from any contamination arising from the present "great defect of these works."

But in connexion with this immunity of the Castle, there was an incident seemingly exceptional, which to minds capable of reasoning, must I think carry a far stronger conviction than if the immunity had been complete. Though it was true of the *Castle proper*, that it drained apart from the town, and was therefore exempt from all unwholesome influences developed in the town sewers, there were certain *dependencies of the Castle* of which such was not the case. On the one side the collegiate residences connected with St. George's Chapel, and on the other side a part of the Royal mews, were exceptions to that general fact:—both of these dependencies draining separately from the general drainage of the Castle; both of them, said Mr. Austin, "draining into the town sewers, and (as being about the "highest points of the whole system) especially exposed to danger "until proper means of ventilation shall be generally provided." To both of these localities—and to the latter of them with considerable severity, the epidemic fever extended. The Castle generally, *as being unconnected with the town-drainage*, was exempt from the town-epidemic;—the cloisters and the mews, *which alone were in communication with the town-sewers*, were alone the exceptions from that immunity.*

Having now, I believe, conclusively shown what were the local causes of the Windsor epidemic, it remains for me with regret to add, that for the existence of those fatal causes the local board of health was not without responsibility. Local boards of health are empowered not only to construct and properly maintain such sewers as shall suffice for the purposes of their locality; but also to regulate the conditions under which those sewers shall have house-drains connected with them, and to require that all such communications between sewers and houses be inoffensive and innocuous to the house-occupants. Experience in the last few years has made it clear that, by an enlightened and effective exercise of these powers, local boards of health (provided the water-supply be not impure) can virtually guarantee urban populations against epidemics of typhoid fever, diarrhœa, and cholera;—but the same experience has not less cogently proved, that, to deal incompetently and slovenly with those resources is to expose urban populations to perhaps

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* It is worth while to observe that fever and diarrhœal diseases have habitually not been rare in Windsor. The appended table (Appendix No. 4), furnished by the Registrar-General, shows that on an average of fifteen years these diseases have occasioned in Windsor annually about twenty-five deaths. This mortality has no doubt mainly depended on the same class of causes as produced the late epidemic; and it may be hoped that, under the better arrangements now promised, not only the recurrence of an epidemic visitation will become impossible, but sporadic cases of similar preventable disease will also be greatly less frequent.

greater risks than they have ever before incurred of suffering from such epidemics; and it would be difficult to conceive an arrangement adapted with more fatal precision to produce this result, than a system of ill-flushed, depositing, unventilated drainage, breathing whiffs or streams of excremental effluvium into the houses which it pretends to make wholesome. Cesspools are bad enough; but unless they be actually within houses, or leaking into water-supply, they cannot often be more dangerous than this mal-execution of the works intended to supersede them. Of the main works of sewerage at Windsor Mr. Austin says, that they "were "well designed, and appear to have been properly executed. If "well attended to and kept in good working order, they would "be complete and efficient in every respect." It is of the house-drainage,—"executed (he says) under different superintendence to "that of the sewers, having been entrusted to the care of suc-"cessive local surveyors,"—that he gives so different an account. And Mr. Austin, after enumerating the very serious defects of house-drainage which he had discovered, together with various other faults in the management of sewerage and scavenage in the town, reports:—"I feel bound to express the decided conviction "to which my examination has led, that the errors and short-"comings to which attention has now been called are the result "of the employment of incompetent services in the superin-"tendence of the house drainage of the town, and to the want of "attention on the part of the surveyor to the proper working of "the general system of drainage, and to the removal of all sources "of impurity. Unless these defects are remedied, the works "which have been executed at so large an expenditure will "remain a source of danger and annoyance." To these of Mr. Austin's remarks I am bound to add of my own knowledge, that opinions, not less decided than his, as to the culpable inefficiency of the surveyor, were expressed by members of the board which employed this officer.

I should have been glad, could I properly have left these facts unreported to your Lordships. But, for reasons which I have just stated, the power of a local board for good or for ill depends so almost entirely on the quality of service which it engages,—especially the lives of populations under systems of collective drainage are so directly affected by the efficiency or inefficiency of a surveyor, that any indolent good-nature or false economy which tolerates an inferior qualification in persons trusted with such important duties, is a very serious danger to the public. The expense of money, the physical suffering, the alarm and sorrow, which Windsor has thus incurred, may perhaps usefully warn other towns against exposing themselves by similar errors to the probability of similar retribution.

In conclusion, I have to report that the facts here stated, with such recommendations * as were suitable for the emergency, were

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* These recommendations were as follows:—1. Nuisances Removal Committee to sit *de die in diem*, actively enforcing the Nuisances Removal Act till all necessary

by your Lordships' direction, brought to the notice of the local board; and subsequently by a letter dated December 11, the clerk of the board informed your Lordships that "although the "local board of health cannot admit that the evils referred to "have occasioned or contributed to the epidemic which has un- "fortunately been so general, still they are doing everything in "their power to remove any causes of complaint or dissatisfaction." He had communicated with Mr. Roe (the original engineer of the main works), who thereupon had "favoured the board with his "valuable advice, which has been attended to. The board has "also appointed an educated and efficient engineer to assist them "in carrying out their sanitary measures; and he is daily "attending to the matters that have been brought before the "board as requiring remedying . . . . The board meet every "week, instead of monthly as heretofore, and have opened an "office for the receipt of information or complaints, at which the "engineer is in daily attendance, and I have directions (should "occasion require) to summon the board oftener than the pro- "posed weekly meetings . . . I can assure you that the local "board is ready at all times to attend to any suggestions that "may be made."

Before leaving the subject of the Windsor epidemic, it is requisite to advert to a minor inquiry which arose in connexion with it. In a memorial received by your Lordships on November 27th, from the vicar, churchwardens, and other inhabitants of Datchet, it was alleged "that typhoid fever, of a malignant "character, has for some time prevailed in the town of Windsor; ". . . that, by the regulations of the Infirmary at Windsor, fever "patients are not admissible, and that there is no other establish- "ment open to them; . . . and that many persons of the labouring "class from the neighbouring agricultural parishes are employed "in Windsor, some of whom, when infected, have returned to "their homes in Datchet and other villages, where the disorder "has, in consequence, been introduced."

Your Lordships having, in consequence, ordered inquiry to be made, it was elicited that cases of "fever"—perhaps both typhoid fever and scarlatina, had, as alleged, been imported from Windsor; but it did not appear that, with exception of a single case, apparently of scarlatina, any attack of disease imputable to contagion had thereupon arisen in Datchet.

I may add that also in Windsor, though only to a small extent, opinions were expressed that the typhoid fever was spreading by personal communication. Without hazarding at present any assertion as to the general question of the contagiousness of typhoid fever, I may say that, on investigating at Windsor cases

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improvements are completed. 2. House-to-house inspection, under the direction of a highly-qualified surveyor, with a view to the discovery and cure of all existing defects of house-drainage. 3. Closure of such public wells as are polluted, or from their situation, liable to become polluted by drainage. 4. Arrangements to avoid the necessity of transporting fever patients from Windsor to other places.

of supposed contagion which were mentioned to me as the most conclusive of their kind, I found, so far as they were concerned, every reason to disbelieve that typhoid fever had been thus communicated. The fact already adverted to, that scarlatina was at the same time prevalent in Windsor, may frequently have been a source of popular error; for this disease is eminently capable of spreading to susceptible persons who are in direct communication with the sick, and I have little doubt that some striking cases in which "fever" had apparently resulted from the arrival of a sick person were cases, not of typhoid, but of scarlet fever.

Accordingly it was not alone for the sake of other districts, but as a suggestion of more equitable treatment for the sick themselves (whose removal during illness might prejudice their chances of recovery) that, in communicating with the local board, I felt it my duty to recommend the adoption of such arrangements as would preclude the necessity of transporting fever-patients from Windsor to other parts of the country.

4.—*The Epidemics of Diphtheria.*

As regards this very important investigation, some time must yet elapse before I can feel justified in laying my results before your Lordships; but I hope it may be possible for me, before the autumnal recess, to present at least a first part of them in the form of a supplement to this Report. Meanwhile I only append (App. No. 5) a schedule of questions, which, after much preliminary study of the subject, and after consulting with several eminent members of my profession, I have framed for the purposes of the inquiry.

5.—*Proceedings by Correspondence and on Documents.*

a. An important class of proceedings to be taken under the Act consists in measures for becoming acquainted with whatever considerable derangement the public health may suffer in any part of the kingdom; since the fact of such derangement (especially when it consists in any great excess of preventable disease) must necessarily be one element in determining the Privy Council to order inquiry to be made into the sanitary circumstances of the population.

Most valuable information for this purpose might apparently be obtained from the comparison of authentic local records of such sickness as is attended in the pauper medical practice of different unions and parishes, and by the officers of large medical charities. But at present no such records are collected; and it is necessary to rely almost exclusively on registers—not of sickness, but of death.

The yearly deaths of the country are communicated to the Registrar-General at four quarterly periods by 2,190 local registrars; and, for many years past, some of these officers have habitually added to their enumeration of deaths short notes of any important fluctuation observed in the local health.

Soon after the Public Health Act, 1858, came into operation, the Registrar-General, at your Lordships' request, addressed a circular letter to the local registrars, desiring that, with the view of promoting the operation of that law, they in future would give immediate notice of the existence of any epidemic, and also in quarterly notes uniformly specify the exact number of deaths occasioned during the quarter, by each of a few important diseases, —especially small-pox, bowel-complaints, and fever.

The Registrar-General has most obligingly undertaken to forward this information for my assistance in the duties of my office; and I have no doubt but it will, in time, admit of being rendered a very fair measure of the fluctuations which it is intended to indicate.

The examination of 491 papers, for the quarter ending with 31st December, showed that in 70 of the number attention was drawn to deaths by diarrhœa; in 159, to deaths by fever; in 174, to deaths by diphtheria; in 329, to deaths by scarlatina, which has been very extensively prevalent almost throughout England; and in 142, to deaths by small-pox.

During the previous quarter, so far as could be judged from fewer local communications, the prevalent diseases were the same, but with a larger proportion of diarrhœa. In some subdistricts, this disease had caused as much as one-seventh, one-sixth, even one-fifth, of the entire mortality. Small-pox, too, had been shamefully prevalent:—in one subdistrict, it alone had occasioned as many as 19 deaths out of 60 from all causes; in another, as many as 20 out of 85; and in various instances, the registrars who mention the disease particularly refer to the local neglect of vaccination.

b. At your Lordships' request, the Registrar-General also desired the local registrars to inform him, with reference to the working of the Vaccination Extension Act, 1853,* what number of duplicate certificates of successful vaccination had been received from medical officers and practitioners during the year 1858. In his last quarterly return the Registrar-General publishes, in detail, the information which he received in answer to this request, and sums the general result as follows:—

"The registrars received 376,798 vaccination certificates, "although they registered the births of 655,627 children.

"Persons vaccinated are not always children; and the children "vaccinated are often born in previous years. But this conside-

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* The Vaccination Extension Act of 1853 (16 & 17 Vict. c. 100.) contains the following provision:—Sect. 4. Upon and immediately after the successful vaccination of any child the medical officer or practitioner who shall have performed the operation shall deliver to the father or mother of the said child, or to the person who shall have the care, nurture, or custody of the said child, a certificate under his hand, according to the form of schedule herein-after inserted marked (A.), that the said child has been successfully vaccinated, and shall also transmit a duplicate of the said certificate to the registrar of births and deaths of the subdistrict in which the operation was performed; and such certificate shall, without further proof, be admissible as evidence of the successful vaccination of such child in any information or complaint which shall be brought against the father or mother of the said child, or against the person who shall have had the care, nurture, or custody of such child, as aforesaid, for noncompliance with the provisions of this Act.

" ration may probably be left out of account; and it may hence " be inferred that the registrars will not receive more than " 376,798 certificates relative to the vaccination of these 655,627 " children.

" A certain number of children die before they can be vac- " cinated. If these are represented by the deaths in the first " three months of life, they will not exceed 8 per cent., or about " 52,400. There will remain 226,429 certificates unaccounted " for. A certain proportion of the children must in spite of the " law have remained unvaccinated, and in reference to another " portion actually vaccinated, the medical practitioners must have " neglected to forward the duplicate certificates to the registrars. " That the latter number is large is evident from the fact, that, " according to the returns made to the Poor Law Board, 455,004 " children in the year that ended on September 29th, 1858, were " vaccinated successfully by the public vaccinators alone. In " other words, their vaccination was paid for by the public. Of the " number vaccinated successfully in the year 1858, by the public " vaccinators, they must have neglected to send the duplicate " certificates to the registrars in at least 78,000 instances; but as " private practitioners sent a certain number of the 376,798 cer- " tificates, the public vaccinators must to that further extent have " have neglected to make the required returns.

" The Act appears to work very unsatisfactorily in all its " registration clauses, which evidently require revision."

In further compliance with your Lordships' wishes on this subject, the Registrar-General has arranged that information, similar to that which he has just collected for the year 1858, shall in future be regularly given in the quarterly notes of the local registrars.

c. In reference to the insufficiencies of vaccination shown by the returns for 1858, and to various questions suggested by the registrars' notes, as to the distribution of preventable disease in different districts of the country, your Lordships have directed about 350 letters to be written to various local authorities respectively empowered to carry out the Vaccination Acts, and Nuisances Removal and Diseases Prevention Acts; but as the completion of this correspondence belongs to the year 1859, I do not now further refer to it.

d. Among complaints which have given rise to similar correspondence, there was one of a peculiar kind. It was alleged by a member of the medical profession, practising in an important seaside town, that the health of the inhabitants was being seriously endangered by the consumption of lead-poisoned water. After communication with the local authority, who forwarded counter-allegations and evidence, your Lordships arrived at the conclusion that there was no case requiring the further interference of the Privy Council.

e. Early in November, information was received by your Lordships, through Her Majesty's Secretary of State for Foreign Affairs, that the very fatal kind of bovine murrain, which is known

by the German name of *Rinder-Pest*, had recently extended beyond those provinces of Russia where it seems to be endemic, and was prevailing among the horned cattle in parts of Poland. Your Lordships having acquired full information as to the precautions taken in those parts to prevent the spread of the disease, and being satisfied that the means there adopted gave sufficient security against any exportation of infected cattle to this country, concluded that no special proceedings here were necessary.

Later in the same month your Lordships were apprised, also through Her Majesty's Secretary of State for Foreign Affairs, that a less important kind of murrain, known here as "the foot and "tongue disease" of horned cattle, had appeared and was rapidly spreading in the northern provinces of Portugal. Your Lordships, feeling assured that the regulations in force at the various ports of the United Kingdom were sufficient to avert all risk of the importation of affected animals (though in fact the disease might already be present here) merely directed that a copy of the above-mentioned communication should be transmitted to the Commissioners of Customs.

B.—On the State of Public Health in England.

In presenting my annual report of proceedings taken under the Public Health Act, I should, generally speaking, hope for your Lordships' permission to use the same opportunity for adverting to such facts as might, at the time, be of most interest in reference to the sanitary state of the people of England. For, by reporting on the two subjects conjointly, I could best contribute my very humble services towards realizing the object of the law. Your Lordships and the Legislature would thus have before you, as terms for comparison, on the one hand an account of what had been done, on the other hand a gauge of what required to be done, for the due protection of life against removable causes of disease.

On the present occasion, however, it is but very briefly that I would refer to the general sanitary state of the country; for it was only just before your Lordships inherited from the late General Board of Health your present responsibilities in this matter, that I had reported to that Board, to the full extent of my then knowledge, on the preventability of many kinds of premature death, and on the local distribution of such deaths in England. This report, having been presented to both Houses of Parliament, is not unknown to your Lordships; and as other engagements of my office have scarcely at all permitted me to resume those important studies, I have but little to add to the information then submitted.

The essential points which I deem it necessary to bring under your Lordships' consideration are—first, *the present very large total of deaths;* and secondly, *the inequality with which deaths are distributed in different districts of the country.*

From the Registrar-General's last quarterly Report I learn, that, in the year 1858, the deaths in England amounted to 450,018. If the views be correct, which in the above-mentioned report I had the honor of submitting in detail for the consideration of Her Majesty's Government, this mortality very greatly exceeds the normal rate of death. It represents an excess of at least 300 deaths a day above what the best authorities consider the natural and attainable death-rate of England ; and if this death-rate, which fortunately is habitual in a tenth part of the districts of England, had not been exceeded by the death-rates of the remaining population, there would have been in the year 1858 a saving of more than 100,000 lives.

In the report already referred to, I have stated the grounds on which it seems certain, that, if only a few simple sanitary faults were corrected throughout the country, the average annual mortality might be reduced even to this large extent. Absence of proper drainage and scavenging, impurity of water-supply, overcrowded, ill-ventilated, uncleansed dwellings ;—unwholesome conditions, connected (but often not necessarily connected) with the pursuit of certain branches of industry ;—neglect of children, incidentally (but not unavoidably) arising from the employment of mothers in factories ;—omission or mal-performance of vaccination : —these few heads indicate our chief sanitary evils, and their average annual fatality may safely be reckoned at more than 100,000 deaths.

As regards the local distribution of this large excess of mortality, I need hardly inform your Lordships that, speaking generally, towns are the chief sufferers ;—partly because they, with reference to the habits and occupations of the people, have certain causes of disease almost peculiar to them ; but still more because they are the chief seats of those very fatal diseases which are engendered or multiplied by filth.*

In 1858, disease seems to have been distributed on this, its usual plan. Seven-tenths of the excess of deaths were suffered by the inhabitants of large towns, who do not constitute half the population of England. The remaining three-tenths were suffered by the inhabitants of small towns and country parishes.†

I have no present means‡ of analysing with perfect exactness the local distribution of particular diseases in 1858. The fact of the large total excess, taken in conjunction with the statement just quoted, and with such information as can be gathered from the

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* It is not that in towns alone the means of public cleanliness are neglected ; for in hamlets and villages, no less than in cities, refuse often remains unremoved from about the dwellings of the people ; but in this case the quantity of nuisance in proportion to the quantity of wholesome ventilation commonly remains small, and an amount of sanitary neglect, which to dense urban populations would be the sure cause of great mischief, remains comparatively harmless in rural districts with scattered population.

† See the last Quarterly Return (No. 40) of Marriages, Births, and Deaths, published by authority of the Registrar-General.

‡ The annual reports of the Registrar-General (necessarily requiring minute arithmetical revision, and consequently taking much time for their preparation) are not published until nearly two years after the expiration of the period to which they relate.

quarterly returns of the local registrars, is all that I yet have to refer to. This, however, assures me that the great bulk of disease is now as unequally distributed among different districts as it was during those years to which my former report related; and that the excess of general death-rate in town districts is now, as it was then, essentially dependent on the very great development of preventable diseases.

That more than half of our annual mortality results from diseases which prevail with a very great range of difference in proportion as sanitary circumstances are bad or good;—that, according to the latest available evidence, some of these diseases prevail twice or thrice, some of them ten or twenty times, some of them even forty or fifty times, as fatally in some districts as in other districts of England; that the result of their excessive partial development is to render the mortality of certain districts from 50 *to* 100 *per cent. higher than the mortality of other districts, and to raise the death-rate of the whole country* 33 *per cent. above the death-rate of its healthiest parts:*—these are the broad facts which I respectfully submit for your Lordships' consideration, to illustrate, so far as existing information permits, the present average state of the public health.

In conclusion I beg to observe, that, even in the very districts to which provisionally I refer as standards of health, there are deaths of a preventable kind; not many, indeed, but enough to satisfy your Lordships that the healthiness of those districts, as compared with perfection, is but of moderate excellence; and enough to show that, if in those districts the population had exhausted all known means for removing the causes of disease, their death rate would have contrasted still more strikingly with that of the unhealthier districts.

I have the honor to be,
My Lords,
Your Lordships' obedient, humble Servant,

JOHN SIMON.

To the Lords of Her Majesty's most
Honorable Privy Council.

APPENDIX.

No. 1.

Instructions for Vaccinators.

(1.) Except there be immediate danger of small-pox, vaccinate only subjects who are in good health. Satisfy yourself that there is not any eruption behind the ears, or elsewhere on the skin ; nor, even in an incipient stage, any irritation from teething. Under no circumstances vaccinate a subject who is seriously ill, or probably under the incubation of measles or scarlet fever. Do not re-vaccinate persons who in infancy have been efficiently vaccinated, unless they be more than 15 years of age, or, if during any immediate danger of small-pox, more than 12 years of age.

(2.) Wherever there are proper means of doing so, vaccinate directly from the vesicle of a previous subject. Moist lymph, conveyed from case to case in a vial, or in other like manner, must not be used for vaccinating later than 18 hours (or, in very hot weather, 12 hours) after it has been taken from its source.

(3.) Vaccinate by four or five separate punctures, so as to produce four or five separate good-sized vesicles ; or, if you vaccinate otherwise than by separate punctures, take care to produce local effects equal to those just mentioned.

(4.) Take lymph only from children who are in perfect health. Especially satisfy yourself as to their freedom from eruption on the skin.

(5.) Take lymph only from perfectly normal vesicles, and not later than the day week after vaccination. Except on emergency, do not take from any one average vaccine vesicle more lymph than will suffice for the immediate vaccination of five subjects, or for the charging of five ivory points. Do not take lymph from cases of re-vaccination.

(6). Register the results of vaccination only after having inspected the cases. Register as "successful" no case of primary vaccination, unless the course of the vesicle have been strictly regular, according to the subjoined description, A. Register as "successful" no case of re-vaccination, unless either the regular vaccine vesicle have ensued, or the results have been normally modified, according to the subjoined description B.

(7.) Use every proper care and exertion to maintain at your vaccinating-station the means of vaccinating successively from subject to subject without the employment of dried lymph. If from any cause your supply of lymph ceases, or becomes unsuitable for further use, make immediate written application for a fresh supply ; addressing your letter "To the Registrar of the National Vaccine Establishment, Privy Council Office, London, S.W."

(8.) Scrupulously observe in your inspections every sign which tests the efficiency and purity of your lymph. Note any case wherein

the vaccine vesicle is unduly hastened or otherwise irregular in its development, or wherein any undue local irritation is excited; and if similar results arise in other cases vaccinated with the same lymph, desist immediately from employing it.

Signs of successful Vaccination and of successful Re-vaccination.

(A.) "When vaccination has been successfully performed on a healthy infant, the puncture may be felt elevated on the second day, and on the third, if examined with a magnifying glass, appears surrounded by a slight redness. On the fifth day a distinct vesicle is formed, having an elevated edge and depressed centre. On the eighth day it appears distended with a clear lymph. The vesicle, on this, its day of greatest perfection, is circular and pearl-coloured; its margin is turgid, firm, shining and wheel-shaped. On the eighth day an inflamed ring or areola begins to form around the base of the vesicle, and, with it, continues to increase during the two following days. This areola is of a circular form, and its diameter extends from one to three inches. When at its height, on the tenth day, there is often considerable hardness and swelling of the subjacent cellular membrane. On the eleventh day the areola begins to subside, leaving as it fades, two or three concentric circles of redness. The vesicle now begins to dry in the centre, and acquires there a brownish colour. The lymph which remains becomes opaque, and gradually concretes; so that about the fourteenth or fifteenth day the vesicle is converted into a hard round scab of a reddish-brown colour. This scab contracts, dries, blackens, and, about the twenty-first day, falls off. It leaves a cicatrix which is permanent in after life, circular, somewhat depressed, dotted or indented with minute pits, and, in some instances, radiated. The above-described local changes, while in active progress, are attended by feverishness; first, from the fifth to the seventh day, so slightly that often the fact passes unobserved; and again more considerably during those days when the areola is about its height; the infant now being restless and hot, with more or less disturbance of stomach and bowels. About the same time, especially if the weather be hot, children of full habit not infrequently show on the extremities, and less copiously on the trunk, a lichenous, roseolar or vesicular eruption, which commonly continues for about a week. When vaccination is performed on such adults or adolescents as have not previously been vaccinated, and likewise when lymph is employed which has recently been derived from the cow, the resulting phenomena, as compared with the preceding description, are somewhat retarded in their course; and the areola is apt to be much more diffused. There is also more feverishness; but lichenous eruption is less frequently seen."

(B.) "When persons who have once been efficiently vaccinated are, some years afterwards, re-vaccinated with effective lymph, there sometimes result vesicles which, as regards their course and that of the attendant areolæ, cannot be distinguished from the perfect results of primary vaccination. But far more usually the results are more or less modified by the influence of such previous vaccination. Often no true vesicles form, but merely papular elevations surrounded by areolæ; and these results, having attained their maximum on or before the fifth day, afterwards quickly decline. Or if vesicles form, their shape is apt to vary from that of the regular vesicle, and their course to be more rapid; so that their maturity is reached on or before the sixth day, their areolæ decline on or before the eighth day, and their scabbing begins correspondingly early. In either case the areolæ tend to diffuse themselves more widely and less regularly, and with more affection of the cellular membrane, than in primary vaccination; and the local changes are accompanied by much itching, often by some irritation of the axillary glands, and in some cases on the fourth or fifth day by considerable febrile disturbance."

GREGORY, revised by CEELY and MARSON.

No. 2.

Minute of National Vaccine Establishment, 17th Nov. 1858.

That the Vaccination Acts of 1840, 1841, and 1853, in creating and developing the parochial system of public vaccination, have greatly reduced the number of applicants at the stations of the National

Vaccine Establishment; that in 1838, the number of vaccinations performed by the National Vaccine Establishment was 18,659; that during the three years 1850–2, the average annual number was 10,713; that during the three years 1854–6, the average annual number was 8,207; that in 1857, the number was 6,327.

That while the operation of successive laws has thus reduced the number of vaccinations, from which lymph is supplied for the public service, the demands for lymph are increasing; that, ordinarily, the National Vaccine Establishment distributes about 215,000 charges of lymph; but that, under the influence of peculiar circumstances, the demand has risen (and might rise again) to about 320,000, an amount nearly 60 per cent. higher than was supplied in 1838, when the sources of supply were nearly three times as numerous as at present.

That under these circumstances, the Board of the National Vaccine Establishment is no longer able to guarantee from its own vaccinating stations, the continuance of a sufficient supply of vaccine lymph, for the requirements of the public.

That abundant sources of lymph exist in the great parochial vaccinating stations, established under 3 & 4 Vict., c. 29, and 16 & 17 Vict. c. 100, at Liverpool, Manchester, Birmingham, Leeds, Sheffield, Newcastle, and other large towns.

That if the Board of the National Vaccine Establishment were satisfied that the public vaccinators of those stations would uniformly exercise proper care in the selection of lymph for transmission, the Board would be prepared to discontinue its own less productive stations, and to recommend the procuring of lymph from parochial vaccinators at the stations referred to; but that so to procure lymph, without having previously obtained that security, would be a dangerous and improper course.

That the Board has no means of instituting the necessary local inquiries into the state of public vaccination in the towns referred to, and therefore hopes that the Lords of the Privy Council will be pleased to direct such inquiries to be made in furtherance of the objects of the National Vaccine Establishment.

No. 3.

Report on the State of the Drainage, &c. of New Windsor.

To the Lord President of the Council.

My Lord,

In accordance with your request, conveyed by letter of the 29th ult., that one of the Engineering Officers of this Department would assist the Medical Officer of the Privy Council in a sanitary inquiry at Windsor, I visited that town on the 30th ult., and devoted three days to its examination.

I have the honour to lay before you the following observations in relation to the works of drainage which have been carried out under the Local Board of Health of that town, and to the present condition of those works.

The main outfall sewer of the town is of unusual dimensions, being no less than eight feet high by four feet wide. It discharges into the Thames at a considerable distance from the town. This sewer was constructed by Captain Vetch, for the drainage of the Castle, and the

sewer from the principal part of the Castle falls into it, entirely distinct from the drainage of the town. A large tank has been constructed at the head of this sewer for flushing; it is abundantly ventilated, and it appears to be scrupulously kept in good working order.

Into this main sewer, at its head, beyond the connexion of the Castle sewer, the whole drainage of the town debouches. The sewers of the lower part of the town take a circuitous route, and have necessarily but little inclination; but the sewers from the upper part of the town have, for the most part, rapid falls into these low-level sewers. The low-level lines are so laid out as to admit of a continuous flow of water through them from the Thames, other lines being provided at their heads with flushing tanks, supplied from the waterworks. The main sewers are of brick, the subsidiary sewers consist of stoneware pipes, all of full but not extravagant dimensions. These works of public drainage were well designed, and appear to have been properly executed. If well attended to, and kept in good working order, they would be complete and efficient in every respect.

The house drainage, in connexion with these sewers appears to have been generally carried out, and the cesspools abolished throughout the town. There are said to be only between 40 and 50 houses still undrained. These private works have been executed under different superintendence to that of the sewers, having been entrusted to the care of successive local surveyors.

The general supply of water to the town is derived from the Thames, filtered through the natural bed of gravel into a tank, whence it is at present forced into the town by waterwheels. A considerable number of the poorer class of houses, however, are still dependent upon wells for their supply of water, the water not having been laid on from the mains of the town. In these houses the waterclosets or soil-pans are supplied only with the waste water from the houses, or with water purposely fetched from the pumps. It is obvious that with such an arrangement great care and supervision would be necessary to keep the drains in good working order by frequent flushings; but as evidence of the great appreciation of the watercloset by the poorest classes, I may mention that of the many premises examined, I found only one soil-pan actually choked, and that was one which was said to form the sole accommodation for the inmates of eight houses.

The main conclusion, however, to which my examination has led is, that one serious defect in the construction of the house drainage throughout the town completely nullifies the advantages which would otherwise have resulted from the excellent plan of works which has been carried out. This is the entire absence of means of ventilation of the drains.

Certain openings from the public sewers have been made in the streets; but the principal ventilation should have been provided in the construction of the house drains, either by special pipes carried up outside buildings where convenient, or by means of the rain-water pipes where they could be safely used for the purpose.

The gases generated in the sewers have a tendency to rise to the higher parts, and especially collect in the house drains, and where they have no other means of escape, these pent up and undiluted gases necessarily have their discharge at the sinks or other inlets to the drains within and about the houses themselves. Even where the traps are perfect, this escape of foul air will take place from these openings every time water is discharged into them; but the traps themselves I found to be frequently imperfect, and the bell traps of the sinks

often loose, so as to favour the continuous admission of foul air to the houses.

The consequences of this defect of ventilation of the drainage works of the town have been aggravated by other circumstances. Owing to the late continuous drought, there has been a diminished current of water flowing through the low-level sewers. The same reason has reduced the power of raising the supply of water for the town, and there was very frequent complaint of its deficiency. The water not being laid on at all to many houses, constant flushing operations would be imperatively demanded, but the arrangements provided for this purpose appear to have been employed only once a month. I found evidence of considerable deposit taking place in the sewers between these intervals, and of much foul smell arising from it when disturbed. Latterly the flushing tanks have been employed once a week, and the sewers have been kept clean. The watercloset and privy buildings belonging to the poorer class of houses are generally of bad construction, and almost universally without any means of ventilation. So little thought seems to have been bestowed upon this matter, that in the corner of a bedroom in the Royal Mews, where a young man was lying ill, I found a water closet boarded off, without any opening of any kind for light or ventilation, except the door into the bedroom.*

The privy arrangements at the infantry barracks seem also to have seriously increased the foul state of the sewer of that neighbourhood. These privies consist of long exposed troughs without water. They are flushed out every morning, and the stench arising in the sewer from this operation is said to be intolerable. These places are now in course of alteration, so that this source of nuisance will be shortly removed.

The circumstances under which this inquiry originated led me to divide the town into three parts for the purposes of examination, taking, firstly, the low level district in the neighbourhood of the outfall sewer, comprising the localities of Gloucester Place, Adelaide Terrace, Brunswick Terrace, &c., a somewhat open district, for the most part consisting of modern middle-class houses ; secondly, the low level, old part of the town, the neighbourhood of Bier Lane and the adjoining courts and alleys, the most crowded and worst class of houses ; and thirdly, the high level district, composed of the best class of houses.

It would have been impossible, except at a considerable sacrifice of time, to make anything like a house-to-house inspection over the town ; but by extending the inquiries as widely as possible, the endeavour was made to obtain a generally correct idea of the present state of the drainage and other works of the district. In the first division above-named, complete house drainage has been generally carried out, and water laid on to the waterclosets and to sinks in the houses. I found considerable evidence of the general prevalence of bad smells at certain times. The explanation of this, which appears to be satisfactory, is that when the wind is in the east it blows up the main outfall sewer,

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* Further Report, January 7.—"I am anxious to add that the bedroom in the Royal Mews, described in the Report as having a watercloset in the corner, without light or ventilation, is said to have been constructed for a hayloft merely, and that it had been improperly appropriated as a bedroom by the family in possession of the adjoining rooms ; but as there was no appearance of a loft about the place, and it adjoins the other rooms, and is entered from the same passage, I had no reason to consider it otherwise than as described."

and forces the foul gases generated in the town sewers and house drains of this immediate locality, into the houses through the waterclosets and sinks, and into the streets through the gullies. This forcible movement of the air in the sewers would have been of no consequence whatever, and would not have been perceptible to the inhabitants, had there been any upper external openings from the drainage works at which any foul air could have had continuous and gradual escape; but, in the absence of such provision, the inhabitants are exposed to this noxious influence in a concentrated and dangerous form..

In the second division referred to, constituting the most part of the town, cholera appears to have formerly raged to a serious extent. This locality is said to have been at that time in a very bad state, and to have suffered much from a horrible ditch which ran through it. When the public sewers were constructed, this ditch was filled up. House drainage has for the most part been here carried out, but it is of a partial character. The cesspools have been generally abolished, and soil pans and drains therefrom substituted in the privies outside the houses in the courts and back premises, but the water has not been laid on from the water-works. The inhabitants are dependent upon public pumps, and generally *there are no sinks or other openings from the drains within the houses themselves.* With two exceptions, I found no complaint of smell from the sewers of this neighbourhood. One woman, whose child had died of fever, complained bitterly of constant smell from the gully immediately opposite to her door, and another woman complained of the smell from a gully opposite to her house whenever the sewers were flushed.

In the third division to which I have alluded, constituting the best portion of the town, the house drainage has been completely carried out, with waterclosets usually within the houses, and sinks in the basements and kitchens. As the sewerage would flow down to the lower levels, the tendency of the foul air disturbed would be to flow upwards, as before stated, and escaping at all such inlets within and about the houses, in the absence of proper ventilating shafts, those who would be most exposed to this noxious influence would naturally be most likely to suffer from whatever evil consequences might arise from it.

I have already explained that the principal part of the Castle is drained quite distinctly from the town sewers, and is apparently quite safe from any contamination arising from the present great defect of these works, but two other portions of the Castle buildings, the Royal Mews on one side, and the Horse-shoe Cloisters on the other, are drained into the town sewers, and being about the highest points of the whole system must be especially exposed to danger until proper means of ventilation shall be generally provided.

In addition to this general defect of want of ventilation of the drains, it must be added that several nuisances exist in the town: pigsties, dungheaps, neglected surfaces, and stinking deposits in gullies. A list of those which have come under my notice will be found in an appendix to this report.

I feel bound to express the decided conviction to which my examination has led, that the errors and shortcomings to which attention has now been called are the result of the employment of incompetent services in the superintendence of the house drainage of the town, and to the want of attention on the part of the surveyor to the proper working of the general system of drainage, and to the removal of all sources of impurity. Unless these defects are remedied,

the works which have been executed at so large an expenditure will remain a source of danger and annoyance. It cannot be supposed, therefore, that the local board would hesitate as to the course to be pursued, even if any great difficulties or expense were involved in the necessary remedies; but fortunately they are not only very easy, but can be carried out at very trifling cost.

I beg to make the following recommendations on the subject; namely, That a thoroughly competent and active surveyor should be immediately employed by the local board; 1. To make a house-to-house inspection throughout the town, to ascertain the present state of the drainage of every house; 2. To report to the board on all premises not yet drained, so that all remaining cesspools may be abolished; 3. To ascertain every instance in which rain-water pipes are so situated that they may be used as ventilators to the house drains, and thus avoid the danger of the admission of foul air to the houses; 4. To ascertain where special iron pipes may be carried up for ventilating shafts at the heads of drains, where the rain-water pipes may not appear to be sufficient; 5. To discover and take means for remedying all defects of the trapping of sinks and other inlets to drains (except the rain water pipes referred to) within or contiguous to houses; 6. To examine and report on all houses drained, but to which no water has been laid on from the works, and in which the water-closets are dependent upon waste water or upon a supply from the pumps, in order that where these are inadequately supplied, and that water from the works can be furnished at a rate which would not be oppressive to the poor, the local board may take means for its supply; 7. To adopt means for the entire abandonment, wherever practicable, of all pumps, the water from which may be ascertained to be polluted; 8. To secure that the flushing inlets from the river be more effectually guarded from the accumulation of rubbish, without impeding the flow of water into the sewers; 9. To see that the flushing tanks throughout the town be kept in good order, and be constantly used, especially in the sewers with little fall, in which there is the greatest tendency to deposit of solid matter; 10. To provide other flushing tanks where desirable; such as at the head of the old sewer between Garden Court and Thames Street; 11. To see that all gulley pits in streets be periodically cleansed and kept charged with water; 12. To provide for the frequent inspection of water-closets not directly supplied with water, and especially of those water-closets which are used by the inmates of more than one house, whether so supplied or not; 13. To direct that an opening be made for ventilation at the upper part of every water-closet or privy, and that those which are in a bad state be repaired, cleansed, and lime whitened; 14. To examine as to the causes of pollution of the Bourne ditch, and to take measures for the prevention of the discharge of refuse into it from the contiguous premises; 15. To prevent the accumulation of nuisances of whatever kind; to forbid the keeping of pigs near houses, and insist on their being kept in a cleanly state, wherever any annoyance is likely to be experienced from them; 16. To seek out and remedy all special defects, such as those noticed in the Appendix. 17. To provide for better scavenging and removal of refuse from houses, and to secure that the surface of roads and places, whether public or private, be so kept that water may run off, and evaporation be prevented.

Lastly, that the local board prepare byelaws, especially under the 34th Section of the Local Government Act, so as to be able to deal with tenements such as the "Boarded Cottages," which are unfit for human habitations.

In concluding this report, I must beg specially to acknowledge the very valuable assistance I received throughout the course of my inquiry from the clerk to the local board, Mr. Charles S. Voules. At great personal inconvenience he accompanied me during my three days' inspection, and took upon himself those duties which under ordinary circumstances should devolve upon a local surveyor.

I have, &c.

9th December 1858. HENRY AUSTIN.

APPENDIX to Mr. Austin's Report on the State of the Drainage of Windsor, being a Statement of some special Defects and Nuisances beyond those of Drainage, which came under notice during a partial Inspection of the Town.

1. Royal Mews, St. Alban's-street.—The surface drainage of stable under Mr. Touns's rooms defective ; prevents proper flow and occasions smell.

2. St. Alban's-street.—Channel to gully grating, opposite post office, out of order, produces stagnant filth.

3. Gloucester-place.—Want of proper removal of refuse from Youngman's back premises.

4. The Bourne ditch.*—Stagnant filth.

5. The Boarded Cottages.—Passage at back, left in neglected state, and dung pit of adjoining stables complained of. Water of well, polluted.

6. Premises in Keppel-street.—Privy in small yard (said to belong to eight houses) choked, dirty and offensive. Public pump immediately contiguous, with sink stopped. Offensive cesspool and pigsties opposite, and yard covered with foul matter.

7. Morgan's-yard in bad state ; pigsties and nuisances, and surface covered with filth.

8. Queen's-square.—Water of public pump polluted ; offensive privies, of wretched construction.

9. Wellington-square.—Surface requires attention.

10. Sheet-street. Gurney's pigsties complained of.

11. Spring-gardens.—Road in bad state ; offensive cesspools ; gully pit opposite Beasley's, Turner, complained of ; the premises of Faulkner, wireworker, offensive ; pigsty ; collection of manure and foul matter.

12. Russell-street. District Visitor's Kitchen.—Water from pump polluted, and offensive smell said to be from cesspool.

13. Collins's-buildings, Bier-lane. — Offensive dung heap of long standing.

14. Bier-lane.—Offensive gully pit opposite Cayley's.

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* "Having been subsequently informed by Mr. Starie, of the Office of Works, that certain house drains were connected with the short length of the ditch which is covered, I took the opportunity of examining this. I found ten openings into the ditch at this part. What number of these may be in actual use, it is difficult to say ; only a small dribble was issuing from one or two of them at the time of inspection, but it is clear they do discharge a certain amount of foul matter into the ditch, which conntined, on an average, three or four inches of deposit in this part. There being no invert to the ditch, the small quantity of liquid discharged from these drains during dry weather appears to soak away in the bottom, which accounts for the entire absence of liquid from the tank itself on my first visit. It is most desirable that the attention of the Local Board should be specially directed to the existence of these drains, in order that they may be at once cut off, and connected with the sewers."—Further Report, January 7.

15. Garden-court, Bier-lane.—Offensive heap of refuse, said to have been emptied from sewers, and left there for weeks. Nuisance in back premises of Nos. 6 and 7, oozes through wall from the premises of Cave, Fishmonger, in Thames-street.

16. Mills's-alley, Thames-street.—Surface drain complained of.

17. Thames-street.—Baldwin, Butcher, slaughterhouse and pigsties. Nine pigs apparently kept with care, but under circumstances which cannot fail to render them offensive at all times, and in summer intolerable. Gully pit, on opposite side of street, said to be offensive during flushing operations.

No. 4.

RETURN of the Total Number of DEATHS, and of the DEATHS from Certain Diseases in the Sub-District of WINDSOR during the Years 1844 to 1857 inclusive, and the First Three Quarters of 1858.

Years.	Total Deaths from all causes.		Number of Deaths, including Deaths in Workhouse.				Deaths in the Workhouse.			
	Including Deaths in Workhouse.	Deaths in Workhouse.	Typhus, Typhoid, Remittent, Infantile, and Relapsing Fever.	Diarrhœa, Dysentery, and Cholera.	Scarlatina.	Croup, Laryngitis of Children under Five Years.	Typhus, Typhoid, Remittent Infantile, and Relapsing Fever.	Diarrhœa, Dysentery, and Cholera.	Scarlatina.	Croup, Laryngitis of Children under Five Years.
1844.	287	33	11	2	4	–	–	1	–	–
1845.	252	29	9	4	5	–	1	1	–	–
1846.	243	30	13	4	7	–	1	–	–	–
1847.	300	39	15	3	6	–	4	1	1	–
1848.	275	29	21	3	8	2	1	–	–	–
1849.	318	46	11	53	10	4	3	4	–	–
1850.	230	37	7	2	1	1	1	1	–	–
1851.	242	29	15	7	2	2	–	–	–	–
1852.	249	26	11	8	2	1	–	–	–	–
1853.	285	26	6	8	6	–	–	–	–	–
1854.	311	39	19	16	45	1	2	4	5	–
1855.	328	47	12	12	30	3	3	2	–	–
1856.	280	33	19	8	4	4	5	1	–	–
1857.	262	31	11	7	2	4	–	–	–	–
1858.	364	27	35	8	37	3	1	–	–	–
Total	4226	501	215	145	169	25	22	15	6	–

Average annual mortality in the sub-district of Windsor in the 14¾ years, 1844 to September 1858 - - - - - - - - To 1000 living 21·78

Population of Windsor sub-district in 1851 - - - - - 12,430

Note.—In calculating the annual average mortality, a correction has been made for deaths in the workhouse returned in the Windsor sub-district, some of which belong to the sub-district of Egham. Of the 494 deaths in the workhouse, 335 have been estimated as belonging to the sub-district of Windsor.

General Register Office, Somerset House,
December 13, 1858.

GEORGE GRAHAM,
Registrar-General.

No. 5.

Heads for Local Inquiry in Districts where Diphtheria has been Epidemic.

1. *As regards the general features of the District.*

a. What is the character of the district as to level, exposure, soil, drainage, and (if rural) cultivation, or (if urban) density of building ?

b. What is the source, and what the general character of the water-supply of the district ?

c. Is the district liable to ague, to autumnal fever or diarrhœa, to bronchocele, or to any other endemic disease ?

2. *As regards the duration, extent, and novelty of the Epidemic in the District.*

a. When was the first, and when the last, case of Diphtheria in the district ?

b. What was the number of attacks of Diphtheria, what the number of deaths occasioned by it, and what the number of houses among which the attacks were distributed ?

§ Append any lists which individual practitioners will furnish, according to the accompanying form, of the cases which they respectively have attended.

c. Is there any local recollection of Diphtheria having prevailed before in the district or neighbourhood ? if so, when ? and to what extent ?

3. *As regards contemporaneous or recent diseases in the District.*

a. Did other varieties of sore-throat (*i. e.* varieties not attended by the formation of false membrane) prevail in the district at about the same time as Diphtheria ? If so, did they precede, or accompany, or follow, its prevalence ? And did they in any cases prove fatal, or present unusual features ?

b. Did scarlatina prevail in the district at about the same time as Diphtheria ? If so, did it precede, accompany, or follow ? And did it present unusual features ?

c. Did erysipelas or puerperal fever ?

d. Did common continued fever ?

e. Did any other disease, either of the human subject or of the lower animals, prevail in the district to an unusual extent, or with unusual features, either during, or shortly before, or shortly after, the prevalence of Diphtheria ?

4. *As regards local and personal conditions predisposing to Diphtheria.*

a. In what number, and with what severity, did cases occur in dry and airy parts of

the district, as compared with low-lying, damp, and confined parts ?

b. In what number, and with what severity, did cases occur in thoroughly well-constructed and well-kept houses or rooms, as compared with houses or rooms in which the atmosphere was offensive from defects of drainage, or from over-crowding and non-ventilation, or from other kinds of uncleanliness ?

c. Had the houses in which Diphtheria was prevalent been previously much subject to any [and, if any, what ?] other kinds of disease ?

d. In what number, and with what severity, did cases occur among persons enjoying affluent or comfortable circumstances of life, as compared with persons suffering privation ?

e. What has been observed as to the influence of age, occupation, habit of body, and personal antecedents, in increasing or diminishing the liability to contract Diphtheria, or to suffer any of its symptoms in a severe form ?

Was any difference in this respect observed between persons who had, and persons who had not, previously had scarlatina ?

5. *As regards the communicability of Diphtheria.*

a. Did it often happen [and if so, give instances] that cases of Diphtheria occurred singly in households where there were children in free communication with the patient ?

b. Did it often happen [and if so, give instances] that all or nearly all the inmates, or all or nearly all the children, of considerable households were eventually attacked with Diphtheria, in houses where one case had arisen ? or that they were attacked with any other kind of sore throat ?

c. Where two or more cases occurred in succession in one house, what commonly was the interval between them ?

d. To what extent is it the case (either as regards the district generally, or as regards particular houses and establishments in the district) that the persons first attacked with Diphtheria had previously been in communication with houses wherein that disease was prevailing ?

or with houses in which some other kind of sore-throat was prevailing ? or with houses in which scarlatina was prevailing, or with houses in which erysipelas, or any other kind of febrile or inflammatory disease was prevailing ?

If in any case Diphtheria seems to have resulted from such communication, what was the nature of the communication? And what time elapsed after the communication before the new case of of Diphtheria commenced?

Did it ever appear that Diphtheria was propagated by accidental inoculation or contact with the morbid secretion of the throat?

If, among persons equally communicating with the sick, some were attacked with Diphtheria, while others remained free from it, to what was this difference attributed?

6. *As regards the symptoms of Diphtheria.*

Did Diphtheria, as observed in the district, differ in any [and, if any, what?] important respect, from the account given of it, generally, in the following paragraphs; viz. :—

a. that the essential local sign of the disease, seen on inspecting the throat of a patient in the early stages of Diphtheria, is the presence of a fibrinous exudation, more or less firmly coagulated upon the inflamed surface of the fauces, tonsils, and pharynx; where, blended with the epithelium of the part, widening as the inflammation extends, and becoming thicker by successive additions to its deep surface, it appears as a continuous raised layer of white or whitish membrane (*diphthera*) and tends after some days to be thrown off, like a slough, in a partially decomposed state?

b. that the diphtheric inflammation is never primarily attended by any ulceration or sloughing of the mucous membrane, though in some cases these processes occur at later stages of the disease: but that always at first there lies beneath the false-membrane a merely excoriated surface; on which, while in this state, there may coagulate, before healthy epithelium is restored, successive new layers of fibrinous matter more or less mixed with the corpuscular products of inflammation?

c. that the diphtheric inflammation, besides generally extending to the mucous membrane of the nose (where also, though rarely, it may begin, and where in either case its presence may occasion epistaxis) sometimes descends along the mucous membrane of the air-passages; superadding, in such cases, the ordinary symptoms and dangers of croup to those of the original affection?

d. that usually the lymphatic glands below the jaw, and sometimes the cellular membrane of the neck, are more or less irritated and swollen during the inflammation of the throat?

e. that the disease is not, except sometimes at its beginning, attended by febrile excite-

ment; but is commonly, throughout its course, marked by signs (often by alarming signs) of depression?

f. that more or less irritation of the kidneys is of very frequent, if not universal, occurrence at some period or other of the disease; involving, while it lasts, an albuminous state of the urine, and the presence in it of microscopical casts of the urinary tubules?

g. that the disease may be complicated with other internal inflammations — especially with pneumonia; and that intestinal hæmorrhage may occur during its course?

h. that patients often remain in a state of anæmia and weakness, even of dangerous weakness, long after the throat-affection has ceased; and that some of them, during this condition, suffer functual nervous disorder—such as impairment of vision, partial loss of sensation, or paralytic or convulsive affection of voluntary muscles?

§ Append any notes which individual practitioners will furnish, of carefully observed cases of Diphtheria, wherein either its less frequent symptoms or complications have occurred, or its common symptoms have been minutely investigated; *e. g.*,

of cases, if any, where cutaneous eruption has appeared—the exact character of which should be specified, as also the period of the disease during which it was visible, and the issue of the cases in which it was observed;

of cases, if any, in which the skin has desquamated;

of cases in which the throat-affection has been accompanied or followed by serious inflammation of internal organs, or by any kind of hæmorrhage;

of cases, if any, in which dropsy has ensued;

of cases in which peculiar nervous sequelæ have been well marked;

of cases, if any, in which a blistered or otherwise excoriated surface of the patient's skin, or the mucous membrane of the pudenda, has taken on anything like diphtheric inflammation;

of cases in which the urine has been specially examined day by day during the disease;

of cases in which the temperature of the body has been noted;

also of any carefully-made post-mortem examination, especially such as may illustrate the internal complications of the disease;

also of any precise observations which may show the value of the particular symptoms as guides to favourable or unfavourable prognosis.

7. *As regards the treatment of Diphtheria.*

a. Has any treatment being found more effectual than the use of ordinary escharotics (*e. g.* nitrate of silver or hydrochloric acid) to arrest the formation of false membrane in the throat? If any cases were treated without escharotic or stimulant applications, what was the result?

b. Has any treatment been found more effectual than the use of alcoholic stimulants to counteract the depression which belongs to severe cases of the disease ?

c. If tracheotomy has in any cases been performed for the relief of laryngeal obstruction arising in the disease, what has been the number and what the result of such cases ? Has any treatment been, under the circumstances, more successful than tracheotomy ?

d. What treatment has been adopted, and what result has ensued, in cases of internal inflammation complicating the disease ?

e. Has any treatment been found more effectual than the use of ordinary tonics to remove the sequelæ of the disease, especially those that affect the nervous system?

f. What knowledge has been obtained as to the fact of any particular drug exerting a specific influence against the disease ?

Privy Council Office, London, S.W., 1859.

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Printers to the Queen's most Excellent Majesty.
For Her Majesty's Stationery Office.

PUBLIC HEALTH.

SECOND REPORT

OF

THE MEDICAL OFFICER OF THE PRIVY COUNCIL,

WITH APPENDIX.

1859.

Presented to both Houses of Parliament pursuant to Act 21 & 22 Vict. Cap. 98.

LONDON:
PRINTED BY GEORGE E. EYRE AND WILLIAM SPOTTISWOODE,
PRINTERS TO THE QUEEN'S MOST EXCELLENT MAJESTY.
FOR HER MAJESTY'S STATIONERY OFFICE.

1860.

TO THE LORDS OF HER MAJESTY'S MOST HONOURABLE PRIVY COUNCIL.

Council Office, Whitehall,

March 31, 1860.

My Lords,

In obedience to the Public Health Act, I have the honour of laying before your Lordships, for presentation to Parliament, a statement of the proceedings taken under the Act during the year 1859.

The principal of these proceedings have been as follows:—

1) Public vaccination has, so far as present circumstances allow, been superintended; regulations, relating to its performance, have been issued; local arrangements, necessary for enabling these regulations to be carried into effect, have been made; and the public supply of vaccine lymph for domestic and foreign distribution has been maintained;

2) Inquiries relating to single localities have been undertaken—

a) in one instance (Bridport) on account of small-pox,

b, *c*) in two instances (Poulton and Kirkby Stephen) on account of fever,

d) in one instance (West Ham) on account of apprehended danger to the public health from nuisances connected with the metropolitan drainage,

e) in one instance (Sheerness and the rest of the island of Sheppey) on account of various matters of complaint alleged by local memorialists;

3) A connected inquiry, relating to one large class of preventable deaths, has been made at Coventry, Birmingham, Wolverhampton, Dudley, Merthyr Tydfil, Nottingham, Leeds, and Manchester (with Chorlton and Salford) into the circumstances under which the inhabitants of these places habitually suffer a very large excess of mortality from Diarrhœa;

4) Another very important connected inquiry, extending by visit to 70 places in 17 different counties, and by correspondence to many others, has been made into the prevailing epidemics of DIPHTHERIA.

The several subjoined papers give detailed information with regard to these matters respectively.

The correspondence of the office, in relation to proceedings under the Act, has involved the issue of nearly 2,000 letters.

I have the honour to remain,

My Lords,

Your Lordships' obedient humble Servant,

JOHN SIMON.

I.

Proceedings in reference to Public Vaccination.

1. *Regulations issued under the Public Health Act*, 1858.

The second clause of the Public Health Act, 1858, authorized the Privy Council from time to time to issue regulations "for "securing the due qualification of persons thereafter to be con- "tracted with by guardians and overseers of unions and parishes "in England for the vaccination of persons resident in such "unions and parishes, and for securing the efficient performance "of vaccination by the persons already or thereafter to be con- "tracted with as aforesaid."

But the law which conferred these powers was in the first instance enacted by Parliament only for a single year; and under this restriction the authority to regulate public vaccination could not be usefully exercised by the Privy Council.

By an Act passed at the end of the last session of Parliament the provisions of the Public Health Act, 1858, were (with exception of the 8th clause) renewed and made permanent; and hereupon the Privy Council proceeded to frame certain regulations, which were issued on December 1st, 1859, and came into effect on the first day of the new year.

Of these regulations, and of other documents connected with them, a copy is hereto appended.

The circumstances to which the regulations were intended to apply, the objects which they aimed at accomplishing, and the collateral arrangements which it was necessary to make before attempting to bring them into effect, require some explanation.

By a first Act of Parliament (Vict. 3 & 4. c. 29) it had been provided that vaccination at the public cost might be claimed of local authorities in any parish of England and Wales. By a second Act (necessary because poor-law guardians and overseers were to be the administrators of the first, and the expenses were to be defrayed out of poor rates) it had been provided that gratuitous vaccination should not place its recipient in the position of persons receiving parochial relief. By a third Act (Vict. 16 & 17. c. 100) it had been made obligatory on parents and guardians, that every child, its health permitting, should be vaccinated within, at furthest, four months from birth; and penalties had been made recoverable from parents or guardians neglecting to fulfil this obligation.

The local arrangements made for public vaccination under the above-quoted laws have consisted in contracts entered into by the guardians or overseers with certain medical men (almost invariably the parochial medical officers) to the effect that the latter will

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severally attend at appointed times and places, either by themselves or legally qualified medical practitioners as their substitutes, and will then and there duly vaccinate every resident person who applies or is brought for the purpose. These arrangements are in force throughout the whole of England and Wales; and the great mass of the population tends to avail itself of them in order to comply with the law which makes infantine vaccination compulsory.

Meanwhile, from time to time strong representations have been made that a considerable share of the current English vaccination has been of an inferior quality. Especially Mr. Marson (who for nearly 25 years has been the resident surgeon of the Small-pox Hospital, and whose opportunities of observation have therefore very greatly exceeded those of any other person in the country) has published conclusive statistics, both as to the very great frequency of sham vaccination, and as to the quantity of fatal small-pox which is due to this cause. He had found that, if vaccinated persons happen to contract small-pox, the mortality among the best vaccinated of the number would be but one-thirtieth part of the mortality among the ill-vaccinated; and yet that the latter comparatively unprotected class had so largely preponderated in his practice, that among 5,347 vaccinated persons whom he had seen suffering with small-pox, only 623 had presented the marks of what he considers thorough vaccination. In a petition on the subject which Mr. Marson addressed to the House of Commons in the summer of 1856, he stated that "the many foreigners "admitted in a series of years as patients at the Small-pox Hospital "had enabled him to observe that vaccination is, as a rule, much "better performed abroad than in England,—that, in fact, it is "far less satisfactorily performed in England than in any other "country in Europe;" and in explanation of this fact he remarked that "no authorized system of vaccination had been "established in England. All persons—medical men, clergymen, "amateurs, druggists, old women, midwives, &c.—are allowed to 'vaccinate in any way he or she may think proper, and the "persons operated on are considered to have been vaccinated." Mr. Marson has published another important statement:—Besides the terribly large proportion of patients, nominally vaccinated, whose vaccination, because of unskilfulness, has been but of partial effect, there are other cases "of frequent "occurrence at the Small-pox Hospital," where patients are in the category of non-vaccinated persons only because bungling operators have failed to vaccinate them;—"with good lymph (he says) and "the observance of all proper precautions, an expert vaccinator "should not fail in his attempts to vaccinate above once in 150

" times. Yet a large number of those who take upon themselves " the duty think they do very well if they succeed, however " imperfectly, five times out of six, and patients often present " themselves with small-pox at the hospital who state they have " been cut five, six, eight times, or more, for cow-pox without " effect."

Far less precise than Mr. Marson's experience, but in its own way equally deserving of consideration, there had been other evidence tending to throw discredit on the quality of much current English vaccination. Among so-called prejudices against the practice there are some which represent a partial truth; erring, indeed, only in so far as they impute generally to vaccination what ought to be imputed exclusively to the vaccinator. Considerable disturbance of health has often followed—sometimes to a dangerous and even fatal extent, the improper acts of persons pretending to vaccinate. If all vaccinators equally had recognised that vaccination is not a mere easy trick of the fingers, but that precautions and minute care are necessary for its full success,—especially if all had been content to study the natural progress of the vaccine vesicle, and the different qualities of material which it furnishes at successive stages, or under accidental disturbances, of its course; if all had thus known how to select lymph and how to preserve it—had inquired into the healthiness of children proposed for vaccination, and had refrained from vaccinating during unfavourable states of health—had been careful as to the condition of children from whom lymph was to be taken, and (though only out of concession to popular belief) had refused to take lymph from unhealthy subjects, little, very little, would have been heard of "prejudices" against vaccination. These, indeed, where they exist, constitute presumptive evidence that in the prejudiced locality vaccination either is, or within local recollection has been, unskilfully administered. Inquiry in such cases would very probably show, either that nominal vaccination has proved useless as a protection against small-pox, or that it has occasioned unexpected suffering to the patient; and that the origin of the scandal has (in the former case) been one of those sham vaccinations against which Mr. Marson protests, or (in the latter case) some neglect or incompetence relating to the choice or preservation of lymph, or the due preparation of the patient. And as it cannot be gainsaid that in parts of England there exist strong impressions against the value—even against the harmlessness, of vaccination, this fact must be taken as at least to some extent corroborating Mr. Marson's conclusions.

It is not possible to say, with any approach to precision, how much

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of the bad vaccination in England has been of official performance. Only, as it is certain that a very large excess of all vaccinations performed in England are vaccinations officially performed under contract with parochial authorities, so it is presumable that whatever statement is true of English vaccination generally, is true of parochial vaccination. But at least the doubt was of grave public importance. For surely the negative ought to be demonstrable. The law had provided a specific machinery for public vaccination; it had in effect made the use of this machinery compulsory for at least two-thirds of the population, as well as optional for the remainder; yet hitherto no security had been taken that the vaccination, so universally offered, and so extensively enforced, should be useful, or even harmless, to the recipient. Reproaches were not unreasonably addressed to the Legislature and the Government, that a poor man was compelled, under threats of penalty or imprisonment, to take his child to be vaccinated, and virtually by some particular vaccinator; but that the vaccination which he was thus obliged to accept might, for aught that the law had provided, be good, bad, or indifferent.

Two other considerations gave increased weight to this argument. On the one hand, it was notorious that great laxity prevailed among parochial vaccinators as to their privilege of acting by deputy; and that often a vaccinator, instead of adhering in this respect to the terms of his contract, to act "either by himself or "by some fully qualified medical practitioner as his substitute," would permit his duty to be performed by assistants or pupils possessing no legal qualification to practise. On the other hand, it was certain that, in the existing state of the law, a person might be appointed parochial vaccinator who had no sufficient knowledge of vaccination,—in fact, even a person who had never seen a vaccination performed, nor ever observed a vaccine vesicle during its course; for it was a natural consequence of the arrangements of public vaccination in this country, that, generally speaking, our ordinary schools of medicine could have no means of practically teaching vaccination, nor hitherto had any of the public vaccinating-stations been opened as schools for the purpose; and accordingly a medical student might complete his studies, and obtain his diploma or licence for practice, without having had any convenient opportunity of learning to vaccinate. His possession of such opportunities would commonly have been contingent on his residing during his pupilage in the house of some surgeon-apothecary; and in this case the value of his opportunities might, according to circumstances, have been great or little. For the absence of such practical opportunities nothing else could

compensate; not because vaccination, as regards the mere manipulation with the lancet, requires much special study; but because to know well the results of vaccination, especially to know well and practically the characters of a vesicle from which it is right to take lymph, requires that cases of vaccination, skilfully performed, should have been attentively observed during their course.

Such were the circumstances under which the Privy Council was called upon to frame regulations "for securing the due qualification of persons to be hereafter contracted with by guardians and overseers of unions and parishes in England for the vaccination of persons resident in such unions and parishes, and for securing the efficient performance of vaccination by the persons already or hereafter to be contracted with as aforesaid." And the main objects to be aimed at were evidently these:—

1) that no one should hereafter be admissible as a contractor for vaccination without producing evidence that he had sufficiently studied vaccination;

2) that no one should hereafter be allowed to act as deputy for any present or future contractor without possessing the same qualifications as are required of contractors themselves;

3) that the contractor should be bound in every essential particular to vaccinate with all such precautions as are known to be necessary for fully and safely attaining the desired result.

There was one real difficulty in making regulations for the fulfilment of these objects,—the difficulty, namely, of procuring satisfactory evidence that the candidate for a vaccination-contract or deputyship really had learnt the business which he wished to undertake. The ordinary apparatus of medical diplomas and licences was here inapplicable: for the various licensing corporations in England have neither the habit nor the means of practically inquiring whether their respective candidates have gained a proper knowledge of vaccination; and hitherto, as already stated, there existed no schools where vaccination could be duly learnt, and whence certificates of proficiency could be received. Accordingly, if the intentions of the Legislature were to be fulfilled, it was preliminarily needful that special establishments should be organized, where vaccination could be studied under skilled guidance, and whence candidates, after due instruction or examination, could obtain such certificates of proficiency as would show them qualified to be contracted with (provided they had the necessary professional licences) for the performance of public vaccination.

With these explanations, the following papers, issued by the Privy Council in December last, represent the proceedings now

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reported on:—first, the Order and appended Instructions, relating to the qualification of contractors, the qualification of deputies of contractors, and the manner in which contracts shall be fulfilled; secondly, the Notification and appended Memorandum, stating the provisions which have been made for enabling all future candidates to acquire the knowledge of vaccination, and the certificate of such knowledge, which henceforth are necessary for rendering them eligible to be contracted with.

In reference to the Instructions for Vaccinators under Contract, it is satisfactory to state that they were framed after extensive consultation with persons most eminent in the subject; especially that in every particular they were minutely discussed with Mr. Ceely of Aylesbury and Mr. Marson of the Small-pox Hospital, the two highest authorities in this country on all to which the Instructions relate; and that these gentlemen (whose kind assistance is very gratefully acknowledged) concurred in recommending them in their present form. The National Vaccine Board has also, with much care, considered the Instructions, and has adopted them for the purposes of its Establishment.

Order.

To the Guardians of the Poor of all Unions and Parishes, to the Churchwardens and Overseers of all Parishes, Townships, and Places in which the Relief to the Poor is not administered by Guardians, in England and Wales, and to all Medical Practitioners.

Whereas by the Public Health Act, 1858, and by an Act since passed to perpetuate the same, it is enacted that the Privy Council may from time to time issue such regulations as they think fit, for securing the due qualification of persons to be thereafter contracted with by Guardians and Overseers of Unions and Parishes in England for the Vaccination of persons resident in such Unions and Parishes, and for securing the efficient performance of Vaccination by the persons already or thereafter to be contracted with as aforesaid;—

Now, therefore, it is hereby ordered, by the Lords and others of Her Majesty's Most Honourable Privy Council (of whom the Vice President of the Committee of the said Privy Council on Education is one) that on and after the first day of January, 1860, the following Regulations shall be in force; viz.:—

Qualification of Contractors.

1. Except where the Privy Council, for reasons brought to their notice, see fit in particular cases otherwise to allow, no person shall in future be admitted as a Contractor for Vaccination unless he possess the same qualifications as are required by the

Orders of the Poor Law Commissioners as qualifications for a District Medical Officer, and produce a special Certificate, given, under such conditions as the Privy Council from time to time fix, by some public Vaccinator whom the Privy Council authorize to act for the purpose, and by whom he has been duly instructed or examined in the practice of Vaccination, and all that relates thereto;—

but the production of this special certificate on occasion of the contract being made may be dispensed with, if the certificate, or some other which the Privy Council judge to be of like effect, have been among the certificates or testimonials necessary for obtaining any diploma, licence or degree, which the candidate possesses;—

and also, in respect of persons legally admitted to practise before this regulation comes into effect, the special Certificate may be dispensed with, on condition that the Contract, during one year from its making, continue subject to the approval of the Poor Law Board;—

and all persons now contracted with shall be deemed to be qualified to be again contracted with.

Qualification of Deputies of Contractors.

2. Under the same conditions as are appointed for the admission of a Contractor, any person qualified to be a Contractor may, on the Contractor's application, be admitted by the Guardians or Overseers to act as his occasional deputy;—

but, if this admission be not part of the original Contract, it must be notified by indorsement upon the Contract; and at least 15 days before it is intended to take effect, a copy of the proposed indorsement, together with all requisite evidence of the qualification of the person whom it is proposed to admit, must be transmitted to the Poor Law Board.

Vaccination and Inspection.

3. All Vaccinations and Inspections under Contract shall be performed by the Contractor in person, or by some other Contractor of the same Union or Parish acting for him, or by a deputy, duly admitted as above;—

but at any station where the Contractor is authorized (as above) to grant certificates, pupils and other candidates, aged not less than 18 years, may, in his presence and under his direction, take part in vaccinating.

All Vaccinations and Inspections under Contract shall be performed in accordance with the annexed "Instructions for Vaccinators under Contract."

Register of Cases.

4. Until some new form of Vaccination-Register be duly prescribed, the person who performs any Vaccination under Contract shall, on the day when he performs it, legibly write in his Register (as now provided) the letter R (for Re-vaccination) against the name of every person, adult or adolescent, who, having in early life been successfully vaccinated, is re-vaccinated; and shall also enter in some column, or in the margin of the Register, the source whence the lymph used in the vaccination was obtained;—

thus: the name, or number (if any) in the Register, of the

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ORDER OF COUNCIL.

subject from whom the lymph was taken; or "N.V.E.," if the lymph was sent by the National Vaccine Establishment; or the name or description of any other source;—

and where the Vaccination or the Inspection is done by a person acting as Deputy for the Contractor, the Deputy shall write the initials of his name in the Register side by side with the entry of the case; viz., in the left margin of the page, if it be a Vaccination which he performs, or in the right margin of the page, if it be an Inspection which he performs.

Contracts.

5. Guardians and Overseers, in their respective Unions and Parishes, shall forthwith take measures to bring the performance of public Vaccination into conformity with these regulations.

WM. L. BATHURST.

INSTRUCTIONS FOR VACCINATORS UNDER CONTRACT.

(1.) Except there be immediate danger of small-pox, vaccinate only subjects who are in good health. Satisfy yourself that there is not any eruption behind the ears, or elsewhere on the skin; nor any febrile state; nor any irritation of the bowels. Under no circumstances vaccinate a subject to whom, from the state or prospects of his health, vaccination is likely to prove injurious. Do not re-vaccinate persons who in infancy have been efficiently vaccinated, unless they be more than 15 years of age, or, if during any immediate danger of small-pox, more than 12 years age.

(2.) In all ordinary vaccinations, vaccinate by four or five separate punctures, so as to produce four or five separate good-sized vesicles; or, if you vaccinate otherwise than by separate punctures, take care to produce local effects equal to those just mentioned.

(3.) Direct care to be taken for keeping the vesicles uninjured during their progress, and for avoiding afterwards the premature removal of the crusts.

(4.) Register the results of vaccination only after having yourself inspected the cases. Register as "successful" no case of primary vaccination, unless the course of the vesicle have been strictly regular according to the subjoined description A.; and register as "successful" no case of re-vaccination, unless either the regular vaccine vesicle have ensued, or the results have been normally modified according to the subjoined description, B. Or, if in either case you register as "successful" any result which does not agree with the subjoined descriptions, write also the word "irregular" in the column of the register where you record the result.

(5.) Endeavour to maintain in your district such a succession of cases as will enable you uniformly to vaccinate with liquid lymph directly from arm to arm; and do not, under ordinary circumstances, adopt any other method of vaccinating. To provide against emergencies, always have in reserve some stored lymph;—either

dry, as on thickly-charged ivory points, constantly well protected from damp; or *liquid*, according to the method of Dr. Husband of Edinburgh, in fine, short, uniformly capillary (not bulbed) tubes, hermetically sealed at both extremities. Lymph successfully preserved by either of these methods may be used without definite restriction as to time; but with all stored lymph caution is necessary, lest in time it have become inert, or otherwise unfit for use. If, in order to vaccinate with recent liquid lymph, you convey it from case to case in a vial or in other like manner, without its being hermetically sealed, do not let more than 18 hours, and in very hot weather not more than 12 hours, intervene before it is used.

(6.) Consider yourself strictly responsible for the quality of whatever lymph you use or furnish for vaccination. Take lymph only from subjects who are in good health; especially satisfying yourself that they are free from eruption on the skin. Take it only from well-characterised, uninjured vesicles. Do not take it from cases of re-vaccination. Take it (as may be done in all regular cases on the day week after vaccination) at a time when the vesicles are plump, either just before the formation of the areola, or, at the latest, not more than 24 hours after the areola has begun to form.

(7.) In vaccinating from arm to arm, and still more in proceeding to store lymph, avoid draining any vesicle which you puncture. From such a vesicle as vaccination by puncture commonly produces do not, under ordinary circumstances, take more lymph than will suffice for the immediate vaccination of five subjects, or for the charging of seven ivory points, or for the filling of three capillary tubes; and from larger or smaller vesicles take only in like proportion to their size.

(8.) Scrupulously observe in your inspections every sign which tests the efficiency and purity of your lymph. Note any case wherein the vaccine vesicle is unduly hastened or otherwise irregular in its development, or wherein any undue local irritation arises; and if similar results ensue in other cases vaccinated with the same lymph, desist at once from employing it.

(9.) If from any cause your supply of lymph ceases, or becomes unsuitable for further use, take immediate measures for obtaining a new supply.

(10.) Keep in good condition the lancets or other instruments which you use for vaccinating, and do not use them for other surgical operations.

N.B. Supplies of lymph, guaranteed by the National Vaccine Board, are furnished on application to all medical practitioners. Letters of application for this lymph should be addressed "To the Registrar of the National Vaccine Establishment, Privy Council Office, London, S.W."

Signs of successful Vaccination and of successful Re-vaccination.

(Gregory, revised by Ceely and Marson.)

Public Vaccination.

ORDER OF COUNCIL.

(A.) "When Vaccination has been successfully performed on a healthy infant, the puncture may be felt elevated on the second or third day, and soon afterwards, if examined with a magnifying glass, appears surrounded by a slight redness. On the fifth or sixth day a distinct vesicle is formed, having an elevated edge and depressed centre. On the eighth day it appears distended with a clear lymph. The vesicle, on this, its day of greatest perfection, is circular and pearl-coloured; its margin is turgid, firm, shining, and wheel-shaped. Late on the seventh, or early on the eighth day, an inflamed ring or areola begins to form around the base of the vesicle, and, with it, continues to increase during the two following days. This areola is of a circular form, and its diameter extends from one to three inches. When at its height, on the ninth or tenth day, there is often considerable hardness and swelling of the subjacent cellular membrane. On the tenth or eleventh day the areola begins to subside, leaving, as it fades, two or three concentric circles of redness. The vesicle now begins to dry in the centre, and acquires there a brownish colour. The lymph which remains becomes opaque, and gradually concretes: so that about the fourteenth or fifteenth day the vesicle is converted into a hard round scab of a reddish brown colour. This scab contracts, dries, blackens, and, about the twenty-first day falls off. It leaves a cicatrix which commonly is permanent in after life, circular, somewhat depressed, dotted or indented with minute pits, and, in some instances radiated. The above described local changes, while in active progress, are attended by feverishness; first, from the fifth to the seventh day, so slightly that often the fact passes unobserved; and again more considerably during those days when the areola is about its height; the infant now being restless and hot, with more or less disturbance of stomach and bowels. About the same time, especially if the weather be hot, children of full habit not unfrequently show on the extremities, and less copiously on the trunk, a lichenous, roseolar or vesicular eruption, which commonly continues for about a week. When Vaccination is performed on such adults or adolescents as have not previously been vaccinated, and likewise when lymph is employed which has recently been derived from the cow, the resulting phenomena, as compared with the preceding description, are somewhat retarded in their course; and the areola is apt to be much more diffuse. There is also more feverishness; but eruption is less frequently seen."

(B.) "When persons who have once been efficiently vaccinated are, some years afterwards, re-vaccinated with effective lymph, there sometimes result vesicles, which, as regards their course and that of the attendant areolæ, cannot be distinguished from the perfect results of primary vaccination. But far more usually the results are more or less modified by the influence of such previous vaccination. Often no true vesicles form, but merely papular elevations surrounded by areolæ; and these results having attained their maximum on or before the fifth day, afterwards quickly decline. Or if vesicles form, their shape is apt to vary from that of the regular vesicle, and their course to be more rapid, so that their maturity is reached on or before the sixth day, their areolæ decline on or before the eighth day, and their scabbing begins correspondingly early. In either case the areolæ tend to diffuse themselves more widely and less regularly, and with more affection of

the cellular membrane, than in primary vaccination; and the local changes are accompanied by much itching, often by some irritation of the axillary glands, and in some cases on the fourth or fifth day by considerable febrile disturbance."

NOTIFICATION.

Whereas under the provisions of the Public Health Act, 1858, and of an Act since passed to perpetuate the same, the Privy Council have this day issued Regulations "for securing the due qualification of persons to be hereafter contracted with by Guardians and Overseers of Unions and Parishes in England for the Vaccination of persons resident in such Unions and Parishes, and for securing the efficient performance of Vaccination by the persons already or hereafter to be contracted with as aforesaid; *and whereas* in these regulations it is, among other other things, required, that, on and after the first day of January, 1860, persons to be contracted with for Vaccination, and persons to be allowed to act in their stead, shall, except in certain cases, produce evidence of being duly qualified in all that relates to the practice of Vaccination, *which evidence* must consist in a certificate given, after due instruction or examination, by some public Vaccinator whom the Privy Council authorise to act for the purpose:

Notice is hereby given,—(1) That, subject to Orders of the Privy Council, the public Vaccinators named in the following list are authorised by the Privy Council to give the required certificates of proficiency in Vaccination to persons whom they have instructed therein, and those whose names in the following list are printed in italic letters are also authorised to give such certificates after examination to persons whom they have not themselves instructed;

(2) That from and after the first day of January, 1860, the vaccinating stations, at which these Vaccinators officiate, will be open, under conditions set forth in the annexed memorandum, for the purposes of teaching and examination; and,

(3) That from time to time, as additions are made by the Privy Council to the list of persons whom they now authorise to give certificates of proficiency in Vaccination, the names of the other persons thus authorised will be published in the *London Gazette.*

PUBLIC VACCINATION.

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Cities and Towns having Educational Vaccinating Stations.	Public Vaccinators authorised to give Certificates of Proficiency in Vaccination.	Places used as Educational Vaccinating Stations.
London - -	*Mr. James Furness Marson*	(*Principal Station*) Surrey Chapel, Blackfriars Road.
	Mr. William Prue Jorden	(*West Station*) 14, Lower Belgrave Street.
	Mr. William Jones Lewis	(*East Station*) 1, Well Street, Wellclose Square.
	Mr. George Simpson -	(*North Station*) Tottenham Court Chapel, Tottenham Court Road.
Birmingham -	*Mr. Samuel Spratly* - -	The General Dispensary.
Bristol - -	*Mr. William Yeoman Sheppard* - - -	7, St. Augustine's Place.
Hull - - -	*Mr. John Hare Gibson* -	29, Nile Street.
Liverpool -	*Mr. Arthur Browne Steele, Mr. John Henry Wilson, Mr. John Fenton,* and *Mr. James Gilmour,* acting conjointly, or at least two of them together -	The Ladies' Charity, Parr Street.
Manchester -	*Mr. Evan Thomas* - -	159, Rochdale Road.
Newcastle -	*Dr. Thomas Fothergill McNay* - - -	Bricklayers' Hall, Castlegarth.
*Oxford - -	*Mr. Edward Law Hussey*	104, St. Aldate's.
Sheffield - -	*Mr. George Atkin* - -	Park Chapel, South Street.

Council Office, 1st December, 1859.

WM. L. BATHURST.

Memorandum of Arrangements made in England for the Public Teaching of Vaccination, and for the granting of such Certificates of Proficiency in Vaccination as will qualify the bearers (if otherwise eligible) to be contracted with by Guardians and Overseers for the Performance of Public Vaccination.

The stations at present established for educational purposes are all in places where there are recognized medical schools. They are stations where the appointed public vaccinator uniformly attends in person, and where the annual number of vaccinations, as compared with the number of vaccinating days, is sufficiently large to promise that the student, during his period of attendance, will, as a rule, always find many cases together for observation. They are stations from which vaccine lymph is furnished for the public service; the Vaccinators in charge of them having, for this purpose, been selected by the National Vaccine Board to be Members of the National Vaccine Establishment.

* This station has since been for the present discontinued.

The Vaccinator of an educational vaccinating-station, during his attendance thereat, will exhibit and explain the course and characters of the vaccine vesicle, will practically teach the best method or methods of performing Vaccination, and of taking lymph for present or future use, will inculcate all precautions which are necessary with regard to the health of subjects proposed for Vaccination, and with regard to the selection and preservation of lymph, and will give all such other instruction as is requisite for the scientific and successful performance of Vaccination and Re-vaccination. During his course of instruction, he will make provision to ensure that always some cases come for inspection on the 10th, as well as on the 8th day; and, for the purpose of showing these cases to his pupils, he will give, on the day appointed for their coming, a second weekly attendance at his station. He will further enable and direct each pupil to see at least six cases of vaccination on at least two other days of their progress; viz., both before the 8th and after the 10th day. In the Teacher's presence, and under his direction, any Pupil, aged not less than 18 years, may take part in vaccinating; but not till he have attended the station on at least two vaccinating-days.

Any person, desirous of being admitted as pupil at an educational vaccination-station, shall pay a fee not exceeding one guinea, and thereupon receive a ticket entitling him to attend the public vaccinations of the Teacher. When the Pupil has attended at the station, during the times of vaccination and teaching, for at least six weeks, the Teacher, if satisfied of his proficiency, shall, on receiving back his ticket, but without further payment, give him a certificate in the appointed form.

At stations where the Teacher is also authorized to give certificates of proficiency in vaccination to persons whom he has not himself instructed therein, such persons will, on appointed occasions, be examined by the Teacher, on payment of a fee not exceeding one guinea, and if he find them competent, receive certificates accordingly. In case of failure to pass this examination, the Candidate may be admitted to a second examination on payment of a fee not exceeding half a guinea.

The Certificate of Proficiency will be understood to imply—and therefore the Teacher who signs it will have taken care to ascertain, that the person to whom it is given can skilfully vaccinate, both with liquid lymph (including such as is preserved in capillary tubes) and also from ivory points;—that he can properly charge ivory points or capillary tubes with lymph;—that he is aware of the relative advantages of recent and preserved lymph, and of all precautions which are requisite in using the latter;—that, from among vaccinated subjects presented for eighth-day inspection, he can select, and give reasons for preferring, those who are fittest to furnish lymph;—that, besides being thoroughly familiar with all local changes which, from first to last, normally ensue on vaccination, he has learnt what causes may accelerate or retard the local changes, or give them undue severity, or otherwise render them irregular;—that he is well-informed as to the constitutional

PUBLIC VACCINATION. ORDER OF COUNCIL.

effects of vaccination (including the eruptions which sometimes follow it) and as to the treatment which cases of vaccination, under various circumstances, may require;—that he knows how far the protective influence of vaccination is affected by lapse of time, and how far by the mode in which vaccination is performed —especially by the number or size of vesicles, and knows generally under what circumstances re-vaccination is to be recommended;—finally that he is acquainted with the laws and regulations relative to public vaccination, and understands the local arrangements which are necessary for maintaining a constant supply of lymph.

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2. *Proceedings relating to the Supply of Vaccine Lymph.*

Supply of Vaccine Lymph.

The Public Health Act, 1858, requires the Privy Council to direct the application of "any money from time to time provided "by Parliament for or towards defraying the expenses of the "National Vaccine Establishment, or otherwise providing for the "supply of vaccine lymph." And, apart from this requisition, it is of course indispensable for the efficiency of public vaccination in England, that constant regard should be had to the quality of lymph which is in use at parochial stations.

In the last Annual Report it was stated that proceedings had recently been commenced by the National Vaccine Board for the purpose of putting the national supply of lymph on a securer basis than it then possessed. During the past year these proceedings have continued in accordance with the principles then adverted to. Unproductive metropolitan stations of the Vaccine Establishment have been discontinued; and, in proportion to their discontinuance, new sources of contribution have, after inspection under the Privy Council, been opened at large provincial towns, and at some parochial stations in London. As the changes are still in progress, it may be convenient to defer to some future opportunity an account of the new organization; except in so far as the proceedings may be gathered from the report of the National Vaccine Board, a copy of which is (Appendix, No. 1) appended.

Other questions of importance in relation to the national lymph-supply have been under consideration during the year.

It is greatly to be desired in a system of public vaccination, that localities should not be too dependent on central assistance; that each vaccinator should, as a rule, be able to maintain in his district such a succession of cases as will enable him habitually to vaccinate with liquid lymph directly from arm to arm; that, against emergencies, he should always have in reserve some

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stored lymph; and that, under these arrangements, he should but very rarely have occasion to address the Vaccine Board for a supply. But, for the attainment of this object, certain local conditions are necessary; and these conditions have hitherto been very imperfectly realized. The foremost evil has been, that, under an injudicious application of the Vaccination Act of 1853, the performance of public vaccination has been subdivided to an extent which leaves comparatively few vaccinators able to maintain their respective successions of lymph. This evil—not confined to rural districts, where sometimes it could not easily be escaped, but abundantly prevailing in large towns (where no trace of it ought ever to exist) and not least in the metropolis, has been of such magnitude as seriously to endanger the efficiency of vaccination in England. Unfortunately it does not admit of immediate complete cure; but the principles on which it must be dealt with are sufficiently obvious, and can easily be made the basis for future arrangements throughout the country. For the attainment of this object it appeared less expedient that the Privy Council (at least at present) should issue a special regulation, than that the Poor Law Board should promote the necessary changes; partly, as opportunities arise, by the exercise of its authority over future contracts, and partly by general recommendations addressed to the contracting parties. Accordingly a Memorandum on the subject was communicated by the Privy Council to the Poor Law Board, and of this memorandum a copy is subjoined.

In intimate connexion with the object of these considerations, is that of promoting a better knowledge of the modes in which vaccine lymph may be stored against times of scarcity. And for this object it appeared desirable to inquire into the merits of a method hitherto little practised in England,—the method of preserving lymph, in a liquid state, within fine, short, uniformly capillary (not bulbed) tubes, hermetically sealed at both extremities. This procedure is extensively practised in Edinburgh by Dr. Husband, the Vaccinator of the Public Dispensary, and, on his plan, by other practitioners in Scotland. But it seems that in England some prejudice has existed against it; partly perhaps because it has been confounded with the entirely different plan of storing lymph in bulbed tubes (within which it is liable to decomposition) and partly perhaps because the procedure requires to be conducted with more care than is necessary for the common English procedure of charging ivory points with lymph, which is then to be let dry upon them. The alleged advantages of Dr. Husband's plan (especially where lymph has to be conveyed

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into hot climates) appeared of so much importance, that the Privy Council ordered inquiry to be made into their reality. This inquiry was conducted by Mr. Ceely, of Aylesbury; whose report on the subject, together with details furnished by Dr. Husband on the particulars of his method, is hereto subjoined. The advantages of the method (subject, of course, to its being adopted with all necessary precautions) are quite conclusively established. Mr. Ceely saw perfect results obtained by vaccination with specimens of lymph which had been thus preserved in a liquid state for as many as seven years. And with the knowledge thus obtained, it was thought right to introduce into the "Instructions for Vaccinators under Contract" a special mention of Dr. Husband's procedure; so as to give the contractor his choice, whether to preserve lymph by this method, or by the more generally-used method of ivory points.

Memorandum on the Subdivision of Public Vaccination, as affecting the Supply of Lymph.

There is reason to believe that the performance of Public Vaccination in England is disadvantageously affected by its present extreme subdivision.

For the satisfactory working of a public vaccinating-station, it is requisite that systematically on each vaccinating day two groups of cases should assemble there;—on the one hand infants, who, having been vaccinated on the day-week preceding, are now (as the law requires) brought back for inspection, and are ready to furnish the vaccinator with lymph for his present proceedings;—on the other hand infants brought for Vaccination, who, if now vaccinated, will on the day-week following be brought back for inspection, and then in their turn contribute lymph for the benefit of further applicants. By the coming together of these two groups of cases, the Vaccinator is enabled to vaccinate from arm to arm; a mode of proceeding, which (as a rule) is of great importance to his success.

It is also requisite that each group of cases should not be too restricted in number. The careful Vaccinator does not indifferently vaccinate from the arms of all infants brought back on the eighth day, but exercises selection among them; and facility for this selection cannot be afforded him, unless there be on each vaccinating day an average return of several vaccinated cases. If his share of the local Vaccination be either too small or too much subdivided among different stations and different days, the cases returning to him for eighth day inspection will on many vaccinating days be too few for his purpose. On all such occasions, he must either omit to vaccinate those who apply to him, or (unless he have recourse to less eligible sources) must vaccinate them with pre-

served lymph, and incur the much greater chances of failure which belong to the usual modes of thus vaccinating.

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Ill-frequented vaccinating-stations (stations, that is to say, where the total number of vaccinations, as compared with the number of vaccinating-days, is too small for the local lymph-supply to be continuously and properly maintained) are now a very prominent feature in our system of public Vaccination. And this state of things is one of serious consequence; not only as implying that at present a large proportion of the vaccinations in England are performed under disadvantageous circumstances; but also because, if it continue, the general lymph supply of England can scarcely fail to become insufficient or deteriorated.

The excessive subdivision which leads to this result, arises in various ways. Sometimes, no doubt, the quantity of Vaccination to be performed within one jurisdiction has been divided among too many performers. But still oftener it is the case, that individual Vaccinators have distributed their respective shares of the public duty among too many stations, or too many vaccinating days; and in some cases the Vaccinator developes the inconvenience to its greatest extent by almost or entirely disusing the appointed station, and habitually performing his vaccinations under contract at the several private dwellings of his patients; a mode of proceeding, which in thinly-populated rural districts may be convenient and even necessary, but which in town-districts can never be necessary, and scarcely ever can fail to be disadvantageous.

It cannot be questioned but that Local Authorities, in adopting the arrangements here animadverted on, have been actuated by the very laudable intention of giving the utmost possible facility to persons desirous of being vaccinated. To any one who has not studied the subject, it naturally appears that the greatest facilities for Vaccination must be given by the largest number of stations, and the largest number of surgical attendances there; whereas in fact (from circumstances which have been here explained) any multiplication of attendances beyond a certain point, can only give spurious facilities for its purpose; and public Vaccination in a district may often be difficult or inefficient, merely because the stations are too numerous or the attendances at them too frequent.

The inconveniences adverted to are not altogether removable. In rural districts, from obvious and unavoidable causes, it never can be as easy as in populous towns to maintain effective Vaccination at once common centre; and in many of such districts the Medical Officer exercises a wise discretion in vaccinating, as opportunities offer, at the scattered dwellings of his patients. Again in instances where small-pox breaks out among a population which presents considerable illegal arrears of Vaccination, the emergency, while it lasts, requires exceptional arrangements.

Exception being made of these, and perhaps other special cases, it seems certain that the Public Vaccination of England would be greatly improved by judicious consolidation of its present too diffuse arrangements. And to effect this object, it seems desirable that Guardians and Overseers, where there is no special reason to

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the contrary, should regulate the details of their respective Contracts in uniformity with the following General Rules:—

(1) that, except at times when there is immediate danger of small-pox, Vaccination be not appointed to be performed at any station oftener than once a week:

(2) that, except at times when there is immediate danger of small-pox, or for special reason in individual cases, Vaccination in town-districts (unless it be of private patients) be performed only at the Public Station:

(3) that, as opportunity offers, especially in urban Unions and Parishes, all unnecessary sub-division of public Vaccination among many districts or stations be discontinued; and that in populous towns, unless under special circumstances, sub-division be not made beyond the point where each vaccinating-station will have annually at least 500 applicants for Vaccination.

On the Method of preserving Vaccine Lymph, practised by Dr. Husband, of Edinburgh.

a. Dr. Husband's Description of the Method.

The tube employed is simple, straight, cylindrical, open at both ends, and of such dimensions as to fulfil the following conditions, upon which it will be found that its peculiar value, as a means for preserving lymph for future every day use, essentially depends. It must be,—

1. In the first place, of such tenuity that it can be sealed instantaneously at the flame of a candle.

2. In the second place, large enough to contain as much lymph as is sufficient for one vaccination.

3. In the third place, long enough to admit of both ends being sealed hermetically without subjecting the charge to the heat of the flame.

4. And, in the fourth place, of such strength as not to break easily in the mere handling.

There need be no difficulty in procuring tubes which perfectly answer this description, only they must be made according to a certain standard, which obviously, from the very nature of the case, is not an arbitrary one, admitting of being altered to suit the notions of different individuals, but one concerning which, within certain limits, there can be no dispute nor difference of opinion.*

The following is the mean of several measurements which I have made of tubes, differing somewhat in size, but all of them

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* This standard is not always adhered to as it ought to be, by the instrument makers, partly owing to the conflicting orders given them by different persons, and hence large quantities of tubes are at this moment in circulation, which, being much too large to be manageable, give a very erroneous idea of them ethod.

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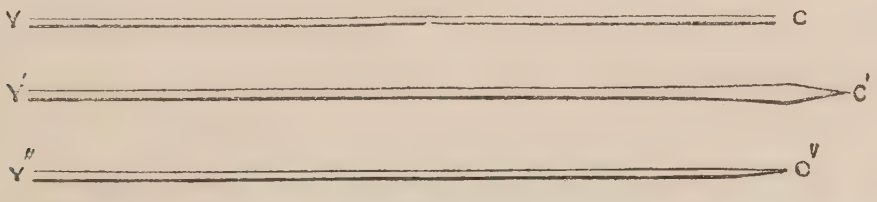
capable of containing a sufficient charge of lymph, and of being sealed instantaneously at the flame of a candle, without subjecting the contained charge to the heat, and also strong enough to bear all necessary manipulations without breaking:—

Average length $2\frac{3}{4}$ to 3 inches.
Diameter $\frac{1}{2\,8}$ of an inch.
Thickness of wall $\frac{1}{1\,9\,0}$ of an inch.
Calibre.

If any one be disposed to find fault with these measurements, and to prefer tubes differently proportioned I have no objection, provided he keep in view the necessity of fulfilling the required conditions. The tubes need not strictly and rigidly conform to the standard laid down, but they must not vary from it except within certain limits, otherwise they become unfit for their purpose.

Although their normal shape is cylindrical (Fig. 1, *c*, *y*,)

Fig. 1.



some of them are more or less fusiform towards one extremity, and terminate there in a fine point (Fig. 1, *c'*, *y'*), or one of the extremities may taper to a point without becoming fusiform (Fig. 1, *c''*, *y''*). In either case this departure from the regular form is accidental, and, as will appear presently, is no disadvantage but rather the contrary.

Having thus described the instrument itself I come now to the mode of using it.

The vesicles having been opened with a lancet in the usual way, the tube held in a position more or less inclined to the horizontal, is charged by applying one end of it (the straight end, if they be not both straight) to the exuding lymph which enters immediately by the force of capillary attraction. Allow as much to enter as will occupy from about one seventh to one half the length of the tube, according as its capacity is greater or less. As a general rule each tube should not be charged with more than will suffice for one vaccination.

It is now to be sealed in one or other of the following ways:

Either, 1st, make the lymph gravitate towards the middle by holding the tube vertically and giving it a few slight shocks by striking the wrist on the arm or table; then seal the end by which the lymph entered by applying it to the surface of the flame of a candle, or any similar flame. It melts over and is sealed immediately.

Proceed with the other end in the same way, but first plunge it suddenly, say half an inch into the flame, and as quickly withdraw it till it touches the surface, and hold it there till it too melts over. It is necessary to plunge it first into the flame, for this reason,

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that if it be once applied to the external surface of the flame it melts over, no doubt, and is sealed; but before you have time to complete the process, and while the glass is still soft, the contained air expands with the heat, and forms a minute bulb, which either gives way on the instant, rendering it necessary for you to break off the end and commence anew, or, what is still worse, remains entire for the time, only to break afterwards, in consequence of its extreme tenuity of wall, by the lightest touch. Mr. Ceely has suggested that while this precaution is necessary for the reason stated it serves also to expel a portion of air, and so leave less air to be sealed up along with the fluid lymph.

Or else, 2dly, the charge having entered, hold the tube with the finger and thumb, covering the inner extremity (*l*) of the column of lymph (*l*, *y*, Fig. 2,) and protecting it from the heat, and draw nearly the whole of the empty portion (*c*, *l*,) through the flame so as to rarefy the contained air, and in withdrawing it

Fig. 2.

seal the further extremity (*c*). The column now passes quickly along towards the middle of the tube as the contained air cools, and you complete the process by sealing lastly the orifice (*y*) by which it entered.

This latter method answers especially well when the tube is below the average size, or has the form (*c*, *y*), in which the opening at (*c*) is so minute that it seals over in the merest fraction of a second.

It should be observed, that in no case is a tube to be laid down until the lymph has been made to pass towards the middle of it, for the fluid concretes quickly about the orifice, and you cannot afterwards detach it without difficulty; but if it be at once made to pass away from the orifice by holding the tube vertically, you may lay the charge down and take half a dozen or more in the same way before sealing them; only if you delay the sealing process too long, more than five or ten minutes perhaps (a delay which need never happen) the lymph within the tube is apt, from evaporation to become adherent, especially if it be more than ordinarily viscid, and it cannot afterwards be blown out when you come to use it.

If the lymph do not exude freely, the tube may require to be drawn several times more or less obliquely across the surface of the vesicle or cluster of vesicles until a sufficient charge has entered; but generally if the exudation be copious, and a drop of some size has formed before you begin to take your supply, the orifice of the tube need not, indeed, ought not, to touch the surface, but is merely to be dipped into the clear fluid; and one may commonly in this manner from one infant's arm charge five or six tubes in almost as many seconds with perfectly pure and limpid lymph, which shall contain neither epithelial scales nor pus

globules nor blood discs, and therefore be, so far, in the best possible condition for preservation.

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In order to obtain the lymph from a tube for the purpose of vaccinating the sealed ends are broken off, and the contents blown out gently on the point of the lancet or vaccinator.

This description may appear to some to be unnecessarily tedious and minute. But I have endeavoured to be as concise as I could, consistently with perspicuity and with the importance of the subject. The difficulty, however, is to convey by description an adequate idea of the facility and expedition with which these manipulations are performed. Your fingers even require training before becoming sufficiently alert to take advantage of the instantaneousness with which the law of capillarity charges the tube for you and with which the heat of the weakest flame seals it.

No one who procures proper tubes and gives them a fair trial, according to the foregoing directions, can fail to perceive that they furnish beyond comparison the easiest and most expeditious means of taking charges of lymph for present or for future use. I say for present or for future use, because their peculiarity is, that they are as perfectly adapted to the purposes of every-day practice, as they are for storing up lymph for long periods, and for transmitting it (as I am in the constant habit of doing) by post or otherwise to foreign parts. It is much easier, and occupies much less time to charge a tube and seal it hermetically than to charge two square plates of glass and wrap them up in paper or tinfoil, or to arm one ivory point, and, after allowing the lymph to dry on it, to envelope it in gold-beaters' leaf and deposit it in some suitable receptacle.

The tubes may be easily and safely sent by post in the following manner:

A flat piece of soft fir, about three inches and a half long, an inch and a half wide, and one-sixth of an inch thick, has a narrow and shallow groove made in it about a quarter of an inch wide, into which the charged tubes, two or more of them, are placed, with perhaps a few filaments of cotton beside them to prevent motion. Another piece of wood of the same size, but which need not be quite so thick, is then laid above the groove and its contents, and the two pieces are joined in any way that is thought most convenient, by being tied or pinned together. Such a package resists the Post Office stamp perfectly. To correspondents in this country I generally send two or three charges; to India and other distant parts seldom fewer than eight or ten. These ought to consist of lymph from several different sources, in order to afford several chances of success in case some of them should prove inert.

The tubes after being charged and sealed may be carried in the pocket, without the slightest risk of being broken, in a glass tube somewhat thicker in the wall than a test tube, and furnished with a common cork.

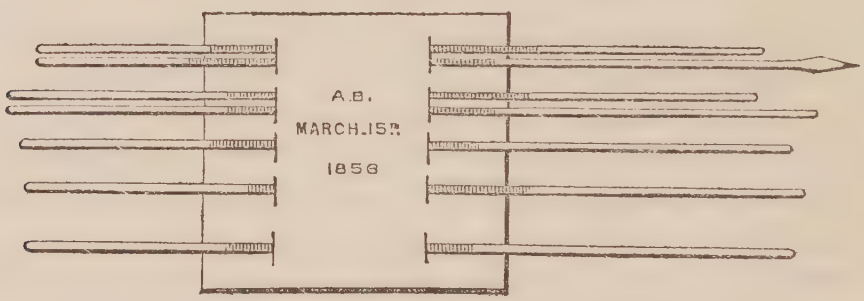
I prefer, however, to carry empty tubes only in a receptacle of this kind, which contains from 60 to 80 of them, and for several reasons to carry those which have been already charged in a small

Supply of Lymph.

box three and a half inches long, an inch and three quarters broad, and three quarters of an inch deep, taking care to keep each supply of lymph separate from the rest, and to affix to it its date, and generally also the name of the infant from which it was taken.

The tubes may be attached to a piece of thin writing paper, in the manner represented in fig. 3. But, I believe, few take this trouble, most medical men here being content to mix empty and charged tubes together at random, without taking note of either date or source; evidently because they find that the date of any given charge is not an element which need be taken into account as materially affecting the chance of vaccinating with success. I found it impossible, however, without some contrivance of the kind just mentioned for distinguishing the dates, to carry on the investigations which were necessary in order to determine whether lymph preserved in this manner possesses a permanent value. And I would strongly recommend those who adopt the method to follow the same course, and never to put a charge aside without affixing its date to it. The little additional trouble required for this purpose contributes to exactitude, and will be found otherwise to be well bestowed.

Fig. 3.



b. Mr. Robert Ceely's Report of Inquiry into the Results.

Some days previous to my departure for Edinburgh, I put myself in communication, by letter, with Dr. William Husband, the Vaccinator at the Royal Public Dispensary and Vaccine Institution, and the inventor of the method of preserving Vaccine lymph, in a fluid state, in fine capillary tubes without bulbs. I informed him of the objects of my intended visit to Edinburgh—solicited his assistance and co-operation, and requested he would kindly vaccinate a number of children with lymph, preserved by his method, at various dates, so that I might be able to observe the results in different stages in as short a time as would be consistent with the satisfactory performance of my inquiry. He promptly and courteously responded to my request, and informed me of the days and hours of vaccination at his station, (that of the Royal Public Dispensary) as well as at that of the New Town Dispensary. . . . At both these stations, if lymph is to be transmitted for immediate home use, small plates of glass are employed for the purpose. But if lymph is either to be preserved at home, or to be transmitted abroad, the fine, short, capillary tubes of Dr. Husband are almost universally employed.

Supply of Lymph.

Dr. Husband began to employ these tubes in 1847 at the Royal Public Dispensary and Vaccine Institution. Since then he has been in the habit of transmitting lymph in this way to the United States of America, to the East and West Indies, China, the Interior of Africa, and many other parts of the world, where they have proved perfectly successful, and are now highly valued; and in several instances have been the means of introducing Vaccine lymph after points and glasses have repeatedly failed.*

Dr. James Hunter, the Vaccinator at the New Town Dispensary, has used the tubes there, and in private practice for several years. Has never seen the least evil or inconvenience from the use of them after long keeping. By every mail he sends a supply of charged tubes to the East Indies to Dr. Christison, who is Superintendent of Vaccination there. He highly approves of them.

Dr. Graham Weir, F.R.C.P., who many years conducted the Vaccinations at the New Town Dispensary, has long used the tubes with satisfaction. Has sent them charged abroad, and still employs no other means.

Dr. William Begbie, F.R.C.P., Physician to the Royal Infirmary, (where he has small-pox wards,) and Lecturer on the Practice of Physic, highly approves of the tubes, and has successfully used lymph so preserved after two years keeping.

Dr. P. H. Watson, F.R.C.S., and Lecturer on Surgery, and Surgeon to the Eye Infirmary, speaks most highly of the value of the tubes. Has used the tubes, charged in Edinburgh, with perfect success in the Crimea. On one occasion of necessity in Edinburgh, and having at the time no other resource, he used a tube which had been charged nine years previously, and with perfect results.

Dr. W. Robertson, F.R.C.P., had used successfully in Turkey, under a temperature of 97° in the shade, lymph which had been preserved in these tubes twelve months.

Dr. J. A. Sidey, surgeon, in large practice with his father, among children, employs tubes and glasses; the latter for immediate use; the former for the preservation of lymph in a fluid and efficient state for a long period, having no confidence in

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* Dr. Husband having favoured me with the perusal of a note lately received by him from Dr. John McGilchrist, of Edinburgh, in reply to certain queries on the above subject, I subjoin extracts from that note:—

"For a period of two years, during which time I took your place as Vaccinator at the Richmond Street Dispensary, in Edinburgh, I had ample opportunity of testing lymph in different forms of preservation. When I first went on duty, I got possession of some tubes which had been charged, probably, by yourself, some months previously; these I reserved till their contents must have been nearly a year old. They proved effectual. Other parcels containing lymph of various ages were experimented with in like manner. The result of my experience being, that the use of the tubes is much more convenient, and that when carefully selected, they are, in general, more to be depended on, as to their contents, especially when old, than the old flat glasses." He adds, "that he sent by post a small box of charged tubes to India, on the application of a medical practitioner there, in consequence of a previous supply having been perfectly successful."

glasses after a fortnight. Has used such charged tubes successfully eighteen months old. Has sent them to China and South America with complete success.

Dr. W. T. Gairdner, F.R.C.P., Physician to the Royal Infirmary, and Lecturer on the practice of Physic, has had experience in the use of the tubes and highly approves of them.

Dr. Pattison uses tubes and glasses; has found the former perfectly satisfactory.

Dr. Seller, late president of the College of Physicians, has repeatedly and successfully employed the tubes.

Dr. Alexander Wood has often used the tubes with great satisfaction.

Dr. Dunsmure, F.R.C.S., late surgeon to the Royal Infirmary, uses nothing else; speaks of them in high terms of approval.

Dr. McCowan, Surgeon to the City Parochial Board, conducts the vaccinations at the City Parochial Dispensary, uses nothing else. Has sent them repeatedly to Singapore.

Dr. Andrew Balfour, now of Porto Bello, always employs them, and had used those, which he had charged in Edinburgh, at Hongkong with perfect success. For several years he continued to employ such lymph, sent from Edinburgh, at Hongkong, at the Vaccination seasons, with almost invariable success. Never saw any evil result from their use after long voyages or change of temperature.

Dr. James Andrew, Secretary to the Royal Public Dispensary and Vaccine Institution, has these tubes in constant use. Has sent them to Hongkong with perfect success.

Dr. Handiside has always used them in private practice and at the Medical Missionary Dispensary.

Mr. Carmichael, surgeon and general practitioner, uses nothing else and speaks highly of them.

Dr. Zeigler uses them constantly and with perfect confidence.

Mr. Bell, surgeon, continually employs them, with entire satisfaction.

Dr. Alexander Simpson, nephew to Dr. J. Y. Simpson, is continually employing them, and speaks most highly of them.

This testimony was obtained at personal interviews with the above-named gentlemen, to whom I was kindly introduced by Dr. Husband. To each and all of them I put the same question emphatically--Did you ever witness any evil results from the use of lymph thus preserved? The invariable answer from all was, "No, never." A few added, "I may occasionally have failed to produce any effect; but that rarely."

Dr. Husband, at my request, applied by letter to Mr. Waddell, late African Missionary, who was then absent from Edinburgh, to furnish him with an account of his experience of the use of lymph preserved in tubes, which Mr. Waddell had employed during his Missionary labours. He states in his letter in reply—"The "lymph which I received from you some years ago proved effec- "tual in Old Calabar. It was the first that had proved effectual.

"Many attempts had been made to vaccinate the natives, by "myself and the surgeons of trading vessels, from lymph pre- "served in the ordinary way between slips of glass; but from "whatever cause, they proved ineffectual. That preserved in "your capillary tubes proved effectual. I operated on several "hundreds, and used every means to preserve records of the "parties, and of the effects. On 300 or so I am certain that they "took effect from their subsequent re-appearance on the fourth "and eighth days. But hundreds of others, grown people, "slaves from a distance, farm servants, &c. escaped observation."

Regular records in detail are kept at the Old and New Town Vaccine Institutions, of the vaccinations and their results, when the patients return. These records appear to have been carefully kept for many years, and seem to be faithfully described. I observed occasional failures recorded of the tube lymph; but no remarks of evil results from its use. Both Dr. Husband and Dr. Jas. Hunter assured me they had never witnessed nor ever heard of any mischief or inconvenience resulting from such lymph, however long kept. I observed, also, that failure of effect bore no uniform reference to the age of the lymph, the oldest lymph being successful, when some much more recent had failed. I have often found this result in reviving dry lymph. Points, repeatedly charged, of comparatively recent date have failed, when those charged long previously have perfectly succeeded. Making due allowance for imperfections in the manner of applying the lymph, whether fluid or liquified, I think there is abundant reason to show that the lymph of all subjects is not equally capable of preservation in any mode. From the recent vesicles of one subject large numbers may be successfully vaccinated, while those of another, equally copious in supply, will yield but few returns. And all attempts to preserve the *later* exudations from the punctured vesicle must end in disappointment.

From the preliminary arrangements made with Dr. Husband, before my arrival in Edinburgh, and a sojourn there of five uninterrupted days, and with the opportunity furnished by three more days on my return from a visit in the Highlands, I personally witnessed the following cases of Vaccination and their results.

Case 1. Vaccinated on 7th August 1859, with lymph dated August 17th 1852, $7\frac{1}{4}$ years old. I saw the cicatrices just after the crusts had fallen. Also two large clusters of normal vesicles on an infant vaccinated from this source.

Case 2. Vaccinated 18th August 1859, from a tube dated February 1859, 6 months old.

Case 3. Vaccinated 18th August 1859, from a tube dated 2nd February 1853, $6\frac{1}{2}$ years old; and also from one dated January 5, 1859, 7 months old.

Case 4. Vaccinated 18th August 1859, from a tube dated May 13, 1854, $5\frac{1}{4}$ years old.

Case 5. Vaccinated 18th August 1859, from a tube dated March 5, 1858, $1\frac{1}{2}$ year old.

Case 6. Vaccinated on 23rd August 1859, from a tube dated 2 February 1853, 6½ years old.

Case 7. Vaccinated 23rd August 1859, from a tube dated 29th September 1858, 11 months old.

Case 8. Vaccinated 20th August 1859, from a tube dated June 17, 1859, 2 months old.

Case 9. Vaccinated 20th August 1859, from a tube dated March 1858, 1½ year old; and also from a tube dated February 1859, 6 months old.

Some of the resulting vesicles were retarded in their development one or two days, as is often the case with lymph revived from the dry state, after long keeping. But all were perfectly normal in other respects. And the lymph obtained from those vesicles, on transmission to succeeding subjects, produced perfectly normal vesicles in all respects.

From the above evidence it is manifest that Dr. Husband's capillary tubes, for several years past, have been preferentially employed in Edinburgh for the preservation of vaccine lymph, and for transmission to all climates; that they are now in constant use both there and abroad, and are employed with safety and confidence; and that, consequently, they are worthy of general adoption by the profession.

For the Public Vaccinator, especially in rural districts, who is required to perform vaccinations at definite periods with indefinite, intermittent, and uncertain supplies of lymph, or is suddenly called upon to vaccinate on the outbreak of small-pox, there can be no greater convenience than a stock of well selected lymph preserved in such tubes. With such, he may become self-dependent for his supplies to the relief of the present over-taxed Public Institutions, and with greater certainty and satisfaction perform his own operations.

The time and pains necessary for the charging, hermetically sealing and discharging of the tubes are not greater than are required for the charging, drying, and discharging of points; to say nothing of the uncertainty of the latter when long kept as compared with the former. Careful selection and limited abstraction of lymph in both cases, is, undoubtedly, necessary to ensure success.

It is much to be desired, I think, that Dr. Husband's method of preserving lymph should be made known to the profession in general.

Tubes made under Dr. Husband's directions are procurable in Edinburgh. Any one sending twelve penny stamps to Mr. Robt. Somerville, 10, Spring Gardens, Stockbridge, Edinburgh, can have a hundred, with printed directions for use, returned in a small deal box, post free.

I cannot, in justice to others, and with satisfaction to myself, conclude this report without the expression of my very great obligations to Dr. Husband, for the liberality and kindness with which he devoted so much time to my service, and the pains he took to procure me access to so many sources of valuable informa-

tion, by introductions to so many men of station, ability and character, to whom I am also much indebted for the greatest courtesy and candour.

By these means, the execution of my task was rendered easy, interesting and agreeable. I earnestly hope it may be deemed satisfactory and useful to you.

II.

Proceedings in reference to Small-pox.

Small-pox having been extensively prevalent in England, inquiry by letter has in many cases been made into the state of public vaccination in the affected districts; and advice has been given as to the steps which might most properly be taken with a view to arresting the epidemic. Small-pox. Generally.

In the metropolis, the great development which towards Christmas last the disease was gaining, rendered more active interference necessary; and here during many weeks an Inspector (Dr. Seaton) has been continuously employed in personal communication with local authorities and their officers as to the best means of diffusing the safeguard of vaccination. Happily it is already certain that these proceedings have been attended with very satisfactory results; but as they were not commenced till the end of the year, and even now are scarcely complete, an account of them may conveniently be reserved for some future occasion. In London.

It having come to the knowledge of the Privy Council, that, during a few months of the year 1858, as many as 41 deaths from small-pox had occurred in the registration sub-district of Bridport (with a population probably under 8,000) and that the registered successful vaccinations were habitually very much in defect of the registered births, it was thought necessary to inquire by an Inspector into the circumstances of this case. The result of the inquiry (made by Dr. Seaton) was to show that vaccination had been very irregularly and inadequately performed. It was ascertained that all the 41 deaths by small-pox were deaths of unvaccinated children; and that at least 36 of the sufferers were of an age at which the law requires that children shall have been vaccinated. From the separate returns of the three parishes of the sub-district, it appeared that the public vaccinations in the parish of *Bridport* during the last 6 years had been respectively 112, 56, 60, 33, 164, and 23; in the parish of *Allington* during the last 4 years respectively 0, 3, 121, and 6; and in the parish of *Bradpole* during the last 3 years respectively 8, 45, and 53. Neglect of vaccination In Bridport.

Small-pox. In Bridport.

is sufficiently shown by the mere difference of these numbers in the different years referred to; but the neglect becomes still more manifest when the vaccinations are compared with the births. In the parish of *Bridport* in 1856, while the births were 150, the vaccinations by the public vaccinator were only 60; and in 1857, when the births were 176, the vaccinations by the public vaccinator were only 33,—whereof but 5 were performed in the first half of the year, the remainder having been performed when the alarm of small-pox had commenced. In the parish of *Allington* the neglect seemed to have been even more culpable; for in 1856, when 60 births were registered, not a single public vaccination was performed; and in 1857, when the births were 63, the public vaccinations were only 3. In the parish of *Bradpole*, just before the commencement of the epidemic, the number of public vaccinations was returned as 8, whilst the births were 43. During the year in which the alarm of small-pox was prevalent, the vaccinations greatly increased; in *Bridport* from 33 to 164, in *Allington* from 3 to 121, and in *Bradpole* from 8 to 49. But no sooner did that alarm subside, than public vaccination was again greatly neglected; the numbers falling in *Bridport* from 164 to 23, and in *Allington* from 121 to 6, while the births in the two parishes were considerably above 200.

These facts are stated in detail, because it is only by such irregularities of public vaccination that small-pox can become epidemic in any part of this country. In any place to which the contagion of this disease is brought, there may be expected the same disgraceful waste of life as here occurred in Bridport, if there be found in it the same disobedience to laws which are made for public protection, and the same neglect of safeguards which are now within everyone's reach.

III.

Proceedings in reference to Outbreaks of Fever in the Town of Poulton-le-Sands, Lancashire, and in the Town of Kirkby-Stephen, Westmoreland.

Poulton-le-Sands.

Fever.

A petition for inquiry from certain inhabitants and ratepayers* of the township of Poulton, Bare, and Torrisholme was addressed

* The signatures were as follows:—John Stewart, F.R.S.E.; J. Roscoe Albin, Civil Engineer; Wm. Caulthey, C.E.; Edward Johnson, Chemist; Charles Ford, M.D., M.R.C.S.Ed.; Wm. Jackson, J.P.; John Marr, Gentleman.

on December 3rd to the Privy Council; alleging that the district was not duly cared for in respect of public cleanliness, and that fever had broken out in the immediate neighbourhood of certain existing nuisances. The memorialists adverted to the existence of a Local Board of Health, "to whom in the usual course com- "plaint ought to be made," but alleged "as the experience of a "course of years, that little is done by this Board, and that little "most inefficiently;" that "with very few exceptions the present "state of the district is as bad and as abominable as it was when an "inquiry was first instituted in 1851;" that "the supply of water "is still bad and inadequate; the drainage and sewerage inade- "quate; accumulated heaps of refuse, remains of fish and other "filth are permitted to remain in close proximity to the houses." After communicating with the Local Board on the subject of this memorial, the Privy Council thought it right that local inquiry should be made into the facts of the case, and Dr. Sanderson was instructed, under the Public Health Act, to make this investigation.

The result of the inquiry was substantially to confirm the statement of the memorialists. It appeared that from 45 to 50 cases of fever* had, during the previous few months, occurred in the little town of Poulton, a place with about a thousand inhabitants; that all but two of these cases had occurred in one part of Poulton,—viz., in that part which is locally known as the Old Town; that this part was distinguished from the New Town in being the seat of those nuisances respecting which the Privy Council had been memorialized; and that the nuisances were really such as had been described.

It also appeared that, though 4½ years had elapsed since the passing of the Nuisances Removal Act, which requires that every local authority under the Act shall appoint, or concur with other local authorities in appointing, a sanitary inspector, the Local Board of Poulton had in effect not made any such appointment; that no complaint-book was kept by the Board; and that their minute-book did not testify to more than a single question of nuisance having been considered by them during the past year.

In a letter dated January 12, 1860, these facts were brought under notice of the Local Board, and pressed upon their consideration. Subsequently the Privy Council has communicated to the Local Board the results of an analysis made by Professor Miller,

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* As regards the character of this fever, Dr. Sanderson remarks,—"The cases, "three of which I had the opportunity of seeing, are referrible as regards their pro- "gress and duration, as well as the character of the symptoms, to the type of fever "designated typhus by medical writers."

Fever.
ulton.

of specimens of water taken from two wells in the old town of Poulton; from which analysis it appeared that in these waters there was a considerable quantity of nitrates,—an admixture which denotes that the soil from which the water is drawn is contaminated with animal matter in a way which may prove most injurious to persons who drink from the wells.

This case (as the later dates indicate) is still under the consideration of the Privy Council.

2. *Kirkby-Stephen.*

Kirkby Stephen.

In a memorial addressed to Her Majesty's Secretary of State for the Home Department, and by him forwarded to the Privy Council, the Rev. Thomas B. H. Thompson, rector of Weyhill, Hants, made certain statements respecting the sanitary state of Kirkby-Stephen, and the inaction of its local authority; which statements led the Privy Council, after communicating with the authority, to order inspection to be made; and Mr. Ord was accordingly instructed to make this inquiry.

The facts locally ascertained were,—that fever * had for about five months been more or less prevailing in Kirkby-Stephen, and that, of the about 1,500 inhabitants, nearly one-seventh part had suffered from it; that it had occasioned at least 11 deaths;† that the local conditions were those of extreme filthiness, affecting both air and water; and that the distribution of the fever in different parts of the town had proportioned itself to these conditions.

Subjoined are some extracts from Mr. Ord's report. They illustrate the conditions under which it may be reasonably expected that typhoid fever and other diarrhœal diseases will attain their

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* The character of the fever is thus described by Mr. Ord :—"As to the nature "and distribution of the fever—in infrequency of diarrhœa, in preponderance of "head and chest affections, in alleged contagiousness, and in the character of what "eruption has been noticed by the medical men, it approaches typhus fever; in "irregularity of course, in absence of crisis, in long protraction of convalescence, and "in tendency to relapse, it resembles typhoid fever. The occurrence of specific or "petechial eruptions has been rare, but, where noticed, the typhic type has existed. "Tenderness of the bowels has not, as a rule, been observed. Among the fatal cases, "two have been preceded by hæmorrhage from the lungs; two deaths are attributed "to cerebral complications, one to peritonitis (a relapsed case) and the rest to "asthenia."

† Mr. Ord makes the following remarks on the death-registers of Kirkby Stephen:—"These records have lost most of their value, owing to imperfections in the entries "under the head of 'Cause of death.' I find the entries marked, in the majority of "cases, as 'not certified,' the registrar not having obtained a medical certificate of "the cause of death. Entries such as 'Stomach complaint' and 'Cramp of the "'stomach' are mixed with others of 'Enteritis' and 'Inflammation of the bowels,' "all uncertified, and gathered only from the friends of the deceased, or from the "verbal communication of the medical attendant. In one case the cause of death is "registered as 'Unknown,' although no inquest appears to have been held." The 11 deaths above mentioned were reported to Mr. Ord by two medical men, in whose practice they occurred. In other practice there may have been other deaths.

full development. It was with a hope to provide sufficient means against the perpetuation of such evils, that in 1855 the Legislature enacted in the Nuisances Removal Act for England, that every place should have its local authority, and that every local authority should appoint, or take part in appointing, a sanitary inspector. But in Kirkby-Stephen not only had no inspector been appointed, but no person or persons were locally known to be in any way responsible for the sanitary care of the town. It was a case in which, according to the law, the guardians and overseers of the poor, with the surveyors of highways, are the authority for carrying the Nuisances Removal Act into effect; but these parochial functionaries had apparently not the slightest consciousness of any responsibility in the matter.

The Privy Council having the facts before them, and having learnt from the Board of Guardians of the Union (Appleby) in which Kirkby-Stephen is situated, who were the persons holding the offices to which is attached the responsibility of carrying the Nuisances Removal Act into operation, proceeded, on January 9, 1860, to address these gentlemen on the subject.

Shortly afterwards (January 16) the Privy Council had the satisfaction of learning that the local authority had held a first meeting, had at length complied with the law by appointing a sanitary inspector, had personally inspected the town, and had commenced active proceedings against the various nuisances adverted to. In a subsequent letter (February 11) the local inspector states that "a great deal has been done as regards "clearing away all filth and dunghills from the town," and that "application has been made to the Poor Law Board to allow the "money now invested in the consols in the guardians' names to "be expended in improving the sewerage."

As the last dates indicate, this case, like that of Poulton, is still under consideration of the Privy Council.

Extract of Mr. Ord's Report.

On the left side of the main street entering from Tevay—

No. 1 house. In tolerably good condition; privy about 15 yards distant; a pigsty, at present built against the wall of the house, in process of removal; 2 small bedrooms for the accommodation of 8 persons. No cases of fever.

No. 2, small. 2 bedrooms, 7 inmates; privy away from house. One case of fever, with diarrhœa.

No. 3. Common lodging-house. 4 small bedrooms among 8 adults. A drain, foul, shallow, untrapped, passes from back yard underneath

FEVER. Kirkby Stephen.

house. The stench thence ascends through the floor into the house, and is much complained of. House damp. One case of fever.

No. 4. A stable adjoining, preceding, and forming part of the row. 3 stalls ; floor hollow, paved ; no drain ; in front a large dunghill with surrounding pools of dark offensive fluid.

No. 5. small. No backdoor or privy ; all filth cast into "syke ;" 4 inmates. One case of fever.

No. 6. The last of the row. No back door ; against the free side wall, behind a small outhouse, is an enormous midden heap, upon which lie large masses of recent human excrement. 8 in family. No fever.

No. 7. Lying back ; front level with back of preceding. This is an old stable converted into a dwelling-house ; it has neither backdoor nor privy. The middenheap of No. 6 just in front of the door, and confined in the recess, pouring effluvia right into this house. Inmates 6. Have lived here only 8 weeks, during which time 2 cases of fever have occurred.

No. 9.

No. 10. Well constructed. Here is a specimen of the best class of privy. It is large and roomy, situate about 10 yards distance from the house. There is no cesspool, but a large shallow pit, placed at the back, receives the excrement and also the ashes from the house, which conceal it and absorb the moisture. The pit is frequently cleaned out. 3 inmates. One case of fever.

No. 11. Unoccupied ; very dirty ; complained of.

No. 12. No privy or drain.

No. 14. Very dirty ; back yard in foul condition ; 2 bedrooms for 9 inmates.

No. 15. "Railway Hotel." Foul drain, quite superficial, passing under house ; 7 inmates ; 5 cases of fever.

No. 16. A barn forming one of the row. At one end of the *interior* is a pen containing pigs, at the other a midden principally consisting of pigs' dung built up to the height of nearly 6 feet against the wall. The floor at its foot is hollow and receives the drainings, which form a horribly foul pool, about 6 feet long by 4 feet broad, in the middle of the building. What part of the floor is not occupied by the pool is imperfectly paved and used as a slaughter floor for the pigs. Stench, foul beyond description. No drainage.

No. 17. One case of fever.

No. 18. Backyard dirty, bad smells from gully about 3 yards distant from front door. *Death* from fever.

No. 19. Nine persons in two bedrooms. 3 cases of fever. One *death.*

No. 20. Present occupiers have had three cases of fever ; former occupiers also attacked.

The inhabitants of these four houses complain bitterly of the stench from a large midden and uncleansed privy belonging to a cowkeeper, occupying No. 21. The fluids from these form large black pools close to the back doors of some of these houses.

In a row of six or seven houses on the right side of the street, opposite the last mentioned, four deaths have occurred from the fever. They are all ill-built, and most of them dirty. Drains, where existing, are imperfect, and in one instance a drain, common to two houses, is completely blocked up with consequent overflow of sewerage. Several of these houses have neither back door nor privy, all slops being thrown out into the front path, which is elevated about three feet above the road. In the edge of the path runs a shallow drain,

which lower down crosses the road to join the "syke." In the road, at the foot of this path, and nearly opposite the middle of the row, is the large open mouth of a well, which is excavated partly beneath the path, partly beneath the

The side of the well against the path is supported by stones which are almost black, apparently from oozings from the path; on the path lie evidences of every kind of filth, being habitually cast out thereon. Water is dipped out in pails from the mouth of the well, in which are seen dead leaves, and other organic matter. Another well which supplies most of the houses on the left side of the south part of the main street, is said to have afforded, during the summer, water impure, both to the eye and palate. It is close to the sewer, and is imperfectly covered in, so that the ground over it is hollowed out, and retains in a pool all moisture thrown on to it. Several houses hard by, which draw their water from purer private wells, have been exempt from the fever so rife all around.

A pump placed in a large open space at the entrance of Sowerpow constitutes the supply of its inhabitants. Removed from all apparent sources of defilement it has afforded a constant supply of pure water, a circumstance which probably accounts for the fact that the fever has exhibited less malignity in this very filthy place.

A fourth well, placed at the back of the house of Dr. Edger, affords water to about nine houses, in every one of which fever has occurred with more or less severity. The pump is fixed to a wall, against the other side of which a large midden is heaped. The water is said to have been impure during the summer, constituting the only difference in the general conditions exhibited by these houses as compared with those continuous with them, which have been entirely free from invasion.

The houses in the northern half of the town draw their water from private wells, or from that situate in the centre of the market place. When in summer the private wells failed, this poured out a constant stream of pure water, and was resorted to by most of the inhabitants of the neighbourhood. The coincidence between the existence of this pump and the immunity from fever enjoyed by the parts around is an important fact.

IV.

Proceedings in reference to the Town of Sheerness, and the adjacent Marsh-Lands of the Thames and Medway.

A memorial, very numerously and respectably signed by "inhabitants of Sheerness and its localities," was addressed to the Privy Council in the month of March 1859, praying for "a full "and searching inquiry to be made into all matters bearing on the "state of the public health in this place and its neighbourhood.

SHEERNESS AND SHEPPEY.

Local Government.

" within the Isle of Sheppey, with the view to efficient measures of " sanitary improvement." The memorialists drew attention to the following passage in a recent Quarterly Report (July 1857) by the Registrar-General:—" The mortality on the high grounds at the " sources of the Thames is at the average of 17 and 18 annual " deaths in 1,000 living; in the low flooded districts on its banks " the mortality rises to 20, 21, 22, 23 in 1,000; in Orsett (Essex) " the mortality is at the rate of 24 in 1,000; in Hoo (the Isle of " Grain) 24; and in Sheppey, containing Sheerness, 24 in 1,000." And the memorialists thus concluded their appeal:—" Closely " connected as is the health of this town and its localities with " that of the large naval and military forces comprising the " station; and comprising as they do, within their population, " some thousands of industrious artizans and mechanics, in addition " to a numerous body of civil officers, all fixed to the spot as " residents by their employment in Government works; and " having regard to the fact, that the above mortality, however " excessive, is no measure of the extent of the evils arising from " loss of work, privation of wages, and weakened constitutions, " attributable to the prevalence of fever and ague; and your " memorialists are led to indulge in the assurance that a readier " attention will, under these circumstances, be given to this their " dutiful appeal, the object of which they are prepared to advance " by their own earnest co-operation."

The Privy Council acceded to the prayer of this memorial. And information, promptly collected on the broad facts of the case, showed, beyond question, the reality of two great grievances:—first, that the town of Sheerness, purporting to have a Local Board of Health, was without the first decent appliances for sanitary well-being; secondly, that the population of the entire island of Sheppey is, to an enormous extent, afflicted with the effects of marsh-malaria, generated partly within the island, and partly on other adjacent mud-lands or marsh-lands about the Swale and the Medway; and that the diseases thus engendered occasion an immense amount of physical suffering, a very large interference with industry of all kinds, and a serious detriment to the efficiency of Her Majesty's service in that important locality.

Provisionally to illustrate the first point (which will hereafter be more fully reported on) it may now suffice to observe that, in the town of Sheerness, though for ten years it had had a so-called Local Board of Health, there existed neither any distributory water-service, nor even a commencement of house-drainage. It was but in natural consequence of this neglect, that the nuisances recorded

in the local inspector's book for the three hottest months of the preceding summer consisted almost exclusively of cases where privies were overflowing upon the public ways of the densely inhabited town; that large ditches of stagnant offensive and injurious matter were, to a considerable extent, immediately contiguous to the dwellings of the population; and that even the poorest inhabitants of the town were purchasing water by the bucket-full.*

Ague.

As regards the second point adverted to, — the influence of marsh-malaria over the whole island of Sheppey is an evil of great magnitude: for the diseases thus produced are both frequent and severe. Of 121 boys and 119 girls, who at the time of the inquiry were present in the National school, 108 boys and 79 girls (or more than three-fourths of the entire number of children) were stated to have had ague; ten other girls were stated to be at the time absent with ague; the number of boys absent for this cause was not ascertained.

And true ague is not the only form in which the endemic influence shows itself. There is abundance of non-intermittent fever, due to the same local cause; and there are frequent cases of neuralgia.

Even the least attack of malarious intermittent involves more than trifling disturbance of health. And, besides its present evil, it often leaves the person who has undergone it liable, during an indefinitely long time, to suffer similar attacks from very slight causes. But the ordinary Sheppey fevers are, in fact, of considerable severity. The ague often leaves abdominal disease; and the non-intermittent fever (sometimes called "short continued;" sometimes called "bilious remittent," though it appears that during its first week no remission of symptoms is observed) commonly lasts from a fortnight to a month, and is a thoroughly incapacitating illness. Occasionally this disease assumes a still more serious complexion. In July 1857, for example, among 40 cases which occurred at Leysdown, 8 died in about the third week of the fever; and the survivors had slow convalescence, extending in some cases to as much as eight or nine months. Indeed, one medical witness (Dr. Macdonough) who had served in the West Indies, and was familiar with tropical diseases, said that in 1854 he had seen at Sheppey a case of this affection quite indistinguishable from the yellow fever of the tropics.

To this terrible malarious influence the whole population of Sheppey is exposed. Perhaps the town of Sheerness suffers from it rather less than some other places in the island. The southern

* Persons paying from 2*s.* to 3*s.* 6*d.* a week for lodging were often found paying from 6*d.* to 10*d.* a week for water.

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parts—Elmley, Harty, Shellness and Leysdown, are said to be the most affected. And in them probably it is most of all the case, that another evil is experienced, of which more or less the whole island complains—the scarcity of proper drinking-water. In these unfortunate parts of the island, not only is the atmosphere rendered malarious by miles of "dry marshes," and a great extent of stagnant, sometimes fœtid and half-dried, ditches, but wells are almost entirely absent, and the inhabitants are often reduced to the necessity of drinking a water which probably is as poisonous to them as the air.

The quantity and intensity of malarious illness habitual to the island cannot be perfectly estimated. But some approximation may be made by studying the statistics of the public establishments at Sheerness. For this purpose, the annexed Tables are

NAVAL FORCE AT SHEERNESS.

	Period to which the Statement relates.	Average Number of Men employed during the Period.	Annual Number of Attacks of the under-mentioned Illnesses, and Number of Days' Work reported as lost thereby.					
			Fever.		Rheumatism and Neuralgia.		Colic and Diarrhœal Diseases.	
			Cases.	Days lost.	Cases.	Days lost.	Cases.	Days lost.
H.M.S. Edinburgh, and Steam Ordinary (Med. Off., Dr. Banks) -	2 years, 1857–58	1,251	130	1,224	64	638	81	270
H.M.S. Waterloo (Med. Off., Dr. Grigor) - -	10 months, Mar. to Dec. 1858	316	†26	157	13	169	26	51 1/7
H.M.S. Formidable (Med. Off., Dr. Newman) -	6 months, July to Dec. 1858	120	†24	138	6	32	12	28
Total -	- -	1,687	180	1,519	83	839	119	349 1/2
Proportion of attacks per 1,000 men employed -	- -	—	106	—	49	—	70	—
Average number of days lost in consequence of each attack - -	- -	—	—	8 2/5	—	10 1/10	—	2 9/10

† In these cases the annual numbers are estimated according to the rate which prevailed during he shorter period of observation.

compiled from various medical returns relating to the naval force in the Medway, the garrison at Sheerness, and the workmen of

GARRISON, ROYAL ARTILLERY. DR. FASSON. THREE YEARS, 1856-8.

—	Year.	Average Number of Men employed.	Number of Attacks of the under-mentioned Illnesses, and Number of Days' Work reported as lost thereby.					
			Fever.		Rheumatis and Neuralgia.		Colic and Diarrhœal Diseases.	
			Cases.	Days lost.	Cases.	Days lost.	Cases.	Days lost.
	1856	861	98	600	—	—	23	67
	1857	689	107	1,117	—	—	72	792
	1858	536	109	1,013	—	—	19	156
		2,086	314	2,730	—	—	114	1,015
Proportion of attacks per 1,000 men employed -		—	150	—	—	—	54	—
Average number of days lost in consequence of each attack - -	-	—	—	$8\frac{3}{5}$	—	—	—	$8\frac{9}{10}$

DOCKYARD. DR. GUNN. THREE YEARS, 1856-8.

—	Year.	Average Number of Men employed.	Number of Attacks of the under-mentioned Illnesses, and Number of Days' Work reported as lost thereby.					
			Fever.		Rheumatism and Neuralgia.		Colic and Diarrhœal Diseases.	
			Cases.	Days lost.	Cases.	Days lost.	Cases.	Days lost.
	1856	1,538	281	2,484	179	1,514	338	1,289
	1857	1,665	230	2,124	78	987	277	1,474
	1858	1,863	230	2,682	64	912	190	1,308
		5,066	741	7,290	321	3,413	805	4,071
Proportion of attacks per 1,000 men employed - -	-	—	146	—	63	—	158	—
Average number of days lost in consequence of each attack - -	- -	—	-	$9\frac{4}{5}$	—	$10\frac{3}{5}$	—	5

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the Sheerness dockyard. According to the testimony of many witnesses, these returns express a very much less amount of illness than really occurs in the branches of public service referred to: for the returns denote not *illness*, as such, but only *absence* on account of illness. Indeed no record is made except where the *entire day* is thus lost;—a circumstance which greatly contributes to suppress the evidence of illness; for the sufferers are, on various accounts, so unwilling to desist from nominal work, htat they contrive by partial service to escape the sick-register, even when they can scarcely exert themselves for the necessary half-day's work.

Apart from the general question of physical suffering unnecessarily caused throughout the whole island of Sheppey by these entirely preventable malarious diseases, it seems a matter of some national moment that, of every 1,000 men employed here in Her Majesty's DOCKYARD, more than a third part (perhaps more than half) suffer during the year from disorders which more or less decidedly are referred to that cause; viz., that 146 of them suffer fever, and that each of the 146 is thus kept from his work for (on an average) $9\frac{4}{5}$ days; that 63 of them suffer neuralgia or other like pains, and that each of these 63 is thus kept from his work for (on an average) $10\frac{3}{5}$ days; that 158 of them suffer from bowel-complaints, which are mainly attributed to the same sort of local influences, and that each of these 158 is thus kept from his work for (on an average) 5 days; besides that a very large amount of unrecorded illness and disqualification prevails among other members of the force;—while, in the garrison of ARTILLERY at the same important station, the prevalence of unnecessary illness is probably of equal amount;—and while, even among the NAVAL FORCE which guards the entrance of the Medway, the same sort of suffering is so prevalent, that Sheerness is said to be spoken of at Chatham Hospital, as "the African station of our home service."

Aaving these facts before them, and supposing, both with regard to the town of Sheerness and with regard to the surrounding marsh districts, that the evils requiring treatment were evils of absent drainage and absent water-supply (respecting the cure of which, engineering advice would be necessary) the Privy Council requested Her Majesty's Secretary of State for the Home Department to permit an engineer of the Local Government Act Office to give his assistance to the inquiry. Mr. Austin, chief superintending inspector of this office, was accordingly commissioned to examine into the state fo land-drainage in Sheppey and other adjacent parts of the country, into the sewerage and house-drainage of Sheerness, into the water-supply of Sheppey, and into the means of amending such defects as he might discover.

Mr. Austin's reports are subjoined; — the first on the town of Sheerness, and on the conduct of its local authority; the second on the even more important question of the Sheppey land-drainage.

The first of these reports was communicated to the local authority, and elicited the (App. No. 2.) appended reply. This letter, impugning some of Mr. Austin's statements, was referred to Mr. Austin for any observations he might wish to make on it; and his entirely conclusive rejoinder is also (App. No. 3.) appended. It is unnecessary here to dwell on the details of this correspondence; but the last paragraph of Mr. Austin's letter justifies a hope, that the proceedings taken by the Privy Council may be attended with results, which in future years it will be gratifying to report. "Having," he writes, "now commented upon the "main points of the Local Board's reply to my report, I am "happy to be able to conclude my letter with the more satisfac-"tory statement that the Local Board have now adopted complete "plans for drainage and water-supply prepared by Mr. Burns, an "engineer who has exhibited considerable skill in such works at "Ely, and the Board now appear desirous of carrying out these "works without delay, thus to some extent redeeming former "neglect. I have examined these plans, and am prepared to report "favourably upon them to the Secretary of State for the Home "Department.

"I have somewhat delayed this letter in order that I might be "able to communicate to you, for the information of the Lords "of the Council, this cheering result, which I believe to be "entirely due to the inquiries directed to be made by their Lord-"ships under the Public Health Act, 1858,—inquiries which "directed public attention to the horrible condition of the place, "and have aroused the Local Board to a sense of their duties and "responsibilities in respect to it."

The second report is rather for the consideration of the Legislature; for, while the alleged evils are unquestionably real and great, it seems that at present there do not exist any local authorities with adequate powers for abating them.

Mr. Austin's Report on Sheerness.

[SHEERNESS.

Mr. Austin's Report.

The town of Sheerness consists of about 2,000 houses, containing about 12,000 inhabitants. It is built in three divisions, or separate districts. Blue Town, the oldest part; Mile Town, the central division; and Ward's Town, the newer portion, chiefly the resort of visitors to the seaside.

The site of the town is for the most part some feet under the level of high water, a natural disadvantage which special appliances, and constant care, could alone counteract.

The Public Health Act was applied to Sheerness in 1849. At the public inquiry held within the district prior to the application of the Act, the state of the town was found to be almost too offensive for description. It was said that the alleys and passages were literally overflow-drains for privies and cesspools; that nightsoil permeated the walls of adjoining houses; that the passages of the houses themselves were, in many cases, the receptacles for filth and manure, and that the effluvia were most sickening; that the people passed their lives over cellars filled with stagnant water and percolations from privy pits.

Certain surface sewers had been put down by Commissioners acting under a local Act of 10th George IV., but these sewers were insufficient even for draining the surface. The inclination of some of them being the wrong way they were charged with mud. There was no pretension to house drainage; it was contrary to the rules for any house drain to communicate with the sewers. The foul water from the houses was in most instances thrown out upon the streets and alleys, and the ground was completely saturated with it. Privy pits could only be dug some four feet deep, because the subsoil being very retentive, water was permanently maintained at that level. In some parts moveable tubs were made use of in the privies, the liquid contents of which flowed into the yards, or permeated the walls.

The water-supply was obtained from two wells. The inhabitants, generally, were supplied from a private well, the water being retailed by water-carriers at a charge of three farthings per "load" of six gallons. The artificers and labourers employed in the dockyard were supplied from the "Navy Well," at a charge of one halfpenny per load. At the most moderate computation the inhabitants were thus paying between 2,000*l.* and 3,000*l.* per annum for a most deficient supply of water.

Such was the state of the town more than ten years ago, when the Public Health Act was applied to the district, and a Local Board of Health was elected, with full powers to put the proper remedies in force. It will scarcely be believed, therefore, that the above description, with very little exception, is equally good for the present moment.

It may be well to trace a brief outline of the proceedings of the

Local Board during their ten years of existence, with reference to the works of improvement required in the town.

Mr. Austin's Report.

A very elaborate survey and plan of the town were in the first instance prepared by the Ordnance Survey Department, and early in 1853 complete plans of drainage and water-supply were matured by Mr. Ranger, the engineer called in by the Local Board for the purpose.

The water-supply was proposed to be obtained from a new well, the water from which was to be raised to a reservoir sufficiently high for the supply of the town at all times under pressure. The plan of drainage was laid out with special regard to the peculiar position of the Town. It being impracticable to accomplish the drainage efficiently and economically by the ordinary means, it was proposed to raise the sewage by steam power, as now accomplished in other districts.

The Local Board appear to have rejected this plan as involving unnecessary expense. Another plan, by a local engineer, in which the same fault in their opinion was embodied, subsequently shared the same fate, and there the matter was left in abeyance for years.

The great privation which the inhabitants were suffering as to water appears at length to have induced the Local Board to advertise for fresh plans for waterworks, and early in last year a plan was adopted by them precisely similar in character to that which was laid before them five years previously. Sanction was granted by the General Board of Health, on the 7th day of May of last year, for raising the necessary funds upon mortgage for the execution of these works, but nothing whatever has yet been done towards the accomplishment of this object.

In the meantime the Local Board appear to have been driven also to take another step as to the drainage of the town. The present drainage, such as it is, has two main outlets; one into the River Medway, near the pier at Blue Town, where it constitutes a very serious nuisance, and the other into the open ditches and "Fleet" immediately contiguous to the houses of Mile Town. These ditches belong to the War Department. The nuisance from them is intolerable, and the local Board having so long neglected to remedy this disgraceful state of things, it has now been determined that after March in next year the drainage of the town shall no longer be permitted to enter these ditches. To this determination on the part of the War Department it seems to be due that another plan of drainage of the town has been proposed on behalf of the Local Board, and presented to the Secretary of State for approval.

This plan has not been prepared by an engineer at all, but by a member of the Local Board, Mr. Atkins, who does not pretend to any engineering knowledge whatever. It is unnecessary to enter upon any minute description of it. It will suffice to say that the sole consideration seems to have been to avoid the necessity for pumping the sewage. Not being aware that the only alternative to this would be the provision of large reservoir sewers sufficiently

capacious to contain the whole of the sewage and rain which would fall into them during the time that the tide would not allow of the discharge of their contents, Mr. Atkins has adopted a system which would cause the whole of the cellars in the low parts of the district to be flooded with the contents of the sewers on every occasion of ordinary rain.

The cost of these works is estimated at nearly 9,000*l.*, and the case presents a striking example of the enormous waste which may be incurred by an ill-judged or ignorant economy. To save the expense of the services of an engineer, the Local Board adopted a plan which, had they been permitted to carry it into execution, would have left the district in a worse state than it is at present. It would have been worse than a mere waste of money. The Secretary of State has, therefore, declined to sanction the raising of the funds, and has recommended the Local Board to call in an experienced engineer to prepare a proper plan.

Such is the position in which the Local Board of Sheerness have placed themselves, after the lapse of ten years, with reference to the two great wants of the districts. On pursuing my inquiry to other points I find that this governing body has so little appreciation generally of its duties and responsibilities that it even declines to appoint a local surveyor to attend to the ordinary business of the office, although the Public Health Act renders this appointment imperative. An inspector of nuisances is said to exist, but all I can learn of him is that he is never seen in the execution of his duties. An examination of the district entirely confirms this assertion. Nuisances abound in all directions, which add their poison to the general malaria of the district.

The only result of the labours of the Local Board which appears to be referred to with any satisfaction, is the sweeping of the streets. The scavenging and removal of solid refuse from the streets is better attended to than before the application of the Public Health Act.

It is true another improvement has just been carried out, but i is of so partial and interested a character that it deserves special notice only on that account. Some new paving has been laid down, at the public expense, not in the miserable courts and alleys where it is most wanted, but in High Street, and Albion Place, Mile Town, in front of the property of the member of the Local Board already referred to, the Mr. Atkins who prepared the plan of drainage. How far this partiality may be justified, I am not prepared to say, but another decision of the Local Board recently taken, in which the public interests have been sacrificed to private advantage, is certainly deserving of severe reprehension.

The district of Ward's Town, or Marine Town, has, for the most part, only lately sprung up, and the several streets remain chiefly in the condition in which the builders left them. Here and there a rough footpath has been raised, with a few planks outside to keep it up, but with this exception no attempt at formation of a roadway seems to have been made. The surface of the ground has not even been levelled, and these places in

wet weather form, for the most part, an unhealthy impassable swamp. At a meeting of the Local Board lately held, a resolution was passed, under the 70th section of the Public Health Act, declaring these private streets to be levelled, paved, flagged and channelled to the satisfaction of the Local Board, whereby they became highways repairable out of the rates of the district. The Local Board will themselves be obliged, at the public expense, to put these streets into the condition in which they have declared them to be.

The upper portion of the parish, including the village of Minster, which has hitherto borne its proportion of the expenses of the Local Board without receiving the slightest benefit of any kind, has recently petitioned the Secretary of State for the Home Department, under the Local Government Act, to be excluded from the district of the Local Board.

It is painful to put upon record this catalogue of neglect and mismanagement, but after so great delay it is important to know what prospect there is of ultimate improvement of the district, at the hands of the governing body as at present constituted. The Local Board is elected by the ratepayers, and, if they alone suffered, one could only represent the facts, and deplore the apathy or ignorance which could allow of the continuance from year to year of so dangerous and wasteful a state of things. But in the present instance the case is different. The health, comfort, and convenience of thousands are affected by the state of the town who have no voice whatever in its management, or of the election of the governing body. The interests of the important establishments from which the town derives its very existence, are altogether ignored. The large numbers constantly employed in the shipping, in the dockyard, and in the garrison, are unrepresented, or nearly so. The Government, which is known to suffer pecuniary loss from the low state of health of the workmen on the spot, is powerless to secure any improvement of the condition of the town.

Surely this is a wrong state of things; and I humbly submit that it is a question for serious consideration, whether better protection should not be sought at the hands of the Legislature for such important interests in this, and other similar places, either by some modification of the constitution of the Local Board, or some power of supervision and control.

It is unnecessary that I should enter upon any detailed description of the engineering works required for the improvement of Sheerness.

With respect to the supply of water, the fullest examinations have satisfied me that an abundant supply of very superior water can be obtained from a well sunk to the level of the sand between the clay and the chalk. The deficiency now complained of from the same source in the dockyard evidently arises from the insufficiency of the works; and it is the decided opinion of Mr. Blaxland, the engineer of the dockyard, who has made much experiment and observation on the subject, that if another well

were sunk near the same spot, the yield would fully meet the increased demand which has arisen in the dockyard.

To bring the supply of water for Sheerness from the chalk springs at Milton, as from time to time proposed, would be attended with far greater expense than sinking a sufficient well on the spot, and the water would be of much harder quality. In either case it would have to be raised to a reservoir on elevated ground, in order to furnish the requisite pressure for supply.

With respect to the drainage of Sheerness, there can be no question that the only efficient and economical plan of dealing with the sewage of a district so situated, is by the application of pumping power, which will relieve the town of its sewage at all times of tide.

As I have before stated, plans have been before the Local Board for years, embodying these systems of water supply and drainage, which, with certain modifications and additions, would fully meet the requirements of the town.

As to the question of cost, I do not hesitate to say that the annual instalment of principal and interest on the total outlay for complete public and private works of water supply and drainage, if properly executed, together with all working expenses, would fall far short of the annual expenses to which the inhabitants are now put for the miserable supply of water to which the neglect or mistaken policy of the Local Board has hitherto doomed them.

When these works shall have been carried out, the large mud bank extending southward from Sheerness towards Queenborough, which is now so complained of at low water, will, at any rate, be deprived of its chief cause of offensiveness, should it not be ultimately determined to reclaim such a valuable site. The defects which are now apparent in the drainage of the old and new barracks, and other government property, can then also be easily remedied; and when the land drainage of the surrounding neighbourhood shall have been accomplished,—to which I refer more particularly in my Report upon the condition of the Isle of Sheppey,—an excellent opportunity for irrigating with the sewage of the town will be afforded. Properly managed, such disposal of the sewage may be made to realize large results, without the slightest detriment or annoyance to the inhabitants.

I have before said that the Local Board is elected by the ratepayers; consequently, so far as they are concerned, the remedy for the pressing evils with which they are surrounded is entirely in their own hands. On their behalf, therefore, I have no suggestion to offer; but, when in their apathy and neglect great public interests are found to be involved, extending far beyond the limits of the mere town population of Sheerness, the question seems to deserve more serious consideration. Sheerness is only one example of towns of this class.

I beg, therefore, in conclusion of my Report, to submit the following recommendation, viz. :—

That in all towns or districts where extensive government establishments exist, powers be sought for protecting those establishments from the danger to which they are exposed whenever the local authorities neglect the duty of maintaining their districts in proper sanitary condition.

I must beg to acknowledge the valuable assistance and attention I received, during my inquiries at Sheerness, from Captain Halstead, R.N., who, being fully aware of the evils from which the locality is suffering, has taken much interest in its improvement, from Mr. Linsdell, of the Royal Engineers' Department, from Mr. Blaxland, Engineer to the dockyard, and from Mr. Foxon.

Mr. Austin's Report on Sheppey.

The Island of Sheppey is estimated to comprise altogether an area of 31,083 acres, or about 48½ square miles. Of this total area about 20½ square miles may be said to be upland, about 14 square miles marsh land, and 14 square miles water, and sea coast and land alternately exposed and covered by the tide.

The marsh lands are distributed over the island. Those immediately contiguous to Sheerness comprise an area of about 1,840 acres. The ditches of these latter marshes measure 36 miles in length, and form an evaporative surface of about 45 acres.

Besides the town of Sheerness, there are three principal villages on the island,—Minster, Queenborough, and Eastchurch. Queenborough, although very small, ought rather to be designated a town. It was formerly a place of some importance from the fact of its returning two members to Parliament. It is a poor, decayed little place, situated at the junction of the River Swale with the Medway, and hemmed in with marshes. Minster and Eastchurch are on rising ground.

The total population of the Island of Sheppey amounted at the time of the census of 1851 to 13,385 inhabitants. Exclusive of Sheerness and Minster, the whole population was only 2,303. The population of Sheerness has since that time considerably increased, but there is no reason to suppose that any increase has taken place in the population of the rest of the island.

The general soil of the district consists of tenacious brown and blue clays for a considerable depth, with little alluvial deposit. Here and there are patches of sand and gravel, and the soil of some of the upland is not of so tenacious a character as that of the marshes.

On the northern side of the island, extending for some four or five miles, an extraordinary landslip has been taking place for many years. The cliff gradually sinks away, oftentimes in large masses, and the debris is washed away by the tide. Several acres of land have already disappeared. It is amidst the soil thus

Sheppey Marshes.

Mr. Austin's Report.

broken away that the Sheppey cement stone is found, from which considerable revenue is derived.

The greatest elevations on the island are from 100 to 150 feet. The level of the marshes is said to be generally about three feet below Trinity High Water Mark. At times of heavy rainfall they are subject to floods; frequent fogs pervade them, and a generally malarious atmosphere is said to prevail. These lands being below the level of high water are dependent for protection from inundation upon the sea walls and river banks with which the island is surrounded, but unlike the Thames marshes and other lands similarly situated *there is no general jurisdiction over these walls, or over the sluices through them.* The safety of the whole of the marshes depends upon the care with which the sea walls and sluices may be attended to by the individual proprietors whose lands abut upon these works. There being no recognized authority over the main works of the marshes there is of course the same absence of control over the level of the water in the ditches.

It is manifest that both on sanitary and agricultural considerations the main improvement required in this district, consisting, as already stated, of a tenacious soil situated below high-water level, would be a complete system of land drainage, with a responsible jurisdiction over the outlets of discharge and over the ditches, so that the level of the water may, at all times, be properly regulated.

This most desirable work, however, can only be carried out in connection with improved means for supplying the district with water. The ditches of the marshes, which form also the fences of the lands and divisions of the properties, are, at the present time, entirely dependent for their supply of water upon the rain which falls upon the immediate surface. Consequently, for fear of the complete exhaustion of the supply during lengthened droughts, the level of the water is kept as high as possible, and is never let off except in wet seasons. During weeks of the hot weather evaporation is always going on from this extended surface of stagnant, offensive liquid, the effect of which in the marshes around Sheerness is materially heightened by the addition of the liquid sewage and filth of the town.

The scattered, poor population of the Island have no other source of water-supply than the rain thus held up in the ditches, or the pitiful quantity which they may be enabled to store in tubs and vessels at their cottages. Great privation is consequently suffered by these poor people, and cattle generally throughout the district are said to be, at times, cruelly distressed in this respect.

The Rector of Eastchurch, the Reverend Mr. Dixon, expressed himself most anxious to have a better supply in this village.

In the midst of this sad picture of general neglect, the injurious effect of which on the health of the district has led to the institution of this inquiry, it is gratifying to be able to point to two cases of agricultural improvement, which not only prove the

facility with which the character of the whole Island may be changed, but demonstrate also,—especially in the case in which the works have been for some time carried out,—that great agricultural advantage will be derived from such works, and that the necessary outlay will make a good return in increased produce, in addition to the results which are to be expected in the improvement of the health of the population.

These cases consist, 1st, of the entire drainage and general improvement of Rayham Farm, comprising 439 acres, the property of his Excellency Lord Harris, and 2nd, of the systematic drainage of about 800 acres of marsh land appertaining to Neat's Court, which is Crown property tenanted by Mr. Leese.

I received from Lord Harris and from Mr. Leese the offer of every assistance during my inquiries in relation to these properties, and I was accompanied in my examination by Mr. Murton of Tunstall, Lord Harris' steward, and by Mr. Webb, by whom the works on both estates had been carried out. I was favoured by these gentlemen with every information and attention.

The lands of Rayham Farm lie upon a gentle slope rising immediately from the marshes. The only marsh land included in the farm is a small portion which was so wet and boggy before the drainage that it was utterly useless, and this is now bearing good crops. The soil of the farm is similar to that of the marshes, a stiff, tenacious clay, and the land is mostly arable. The drains have been laid from 16 to 22 feet apart, and four feet deep. The average cost of the drainage was 6*l.* per acre, but when labour was dearer the cost rose to 7*l.* and 8*l.* per acre.

This farm was taken in hand by Lord Harris at Michaelmas 1849, as a tenant could not be obtained for it at a higher rent than 100*l.* per annum.

An elaborate statement of the operations and expenditure on the farm for nine years, ending Michaelmas 1858, has been published by Lord Harris, the object of his Lordship being "to show "the nature and cost of expenditure in cultivating a farm of this "description, of very heavy tillage, and to prove how far the "outlay of draining, and the cost of erecting steam machinery "will be repaid by reducing the expenditure, and making the "farm more remunerative in wet seasons."

The sum of 3,200*l.* was expended on the drainage of the land, which was carried out in the six years from 1852 to 1857 inclusive. Eight new cottages, and steam engine, machinery, and buildings, were erected at a total cost of 1,900*l.*

It has been said that in 1849 a tenant could not be obtained for this farm at a higher rent than 100*l.* per annum. During the first year of its being taken in hand by Lord Harris, the balance towards rent was 181*l.* 2*s.* 1¼*d.* During the second year it was as low as 20*l.* 15*s.* 7¾*d.* During the third (1853) it rose to 268*l.* 0*s.* 1¼*d.*, and from that time the rapid increase in the return was very remarkable. The average balance towards rent during the last five years after paying interest on outlay or drainage,

and for machinery, buildings, and cottages, has amounted to 914*l.* 10*s.* 1½*d.*

The drainage of the marsh lands of Neats Court was executed by Mr. Webb, under the direction of Messrs. Clutton, for the Office of Woods and Forests. The sum of 6,000*l.* was borrowed for 22 years at 6 per cent. interest, for the improvement of the estate. The work has only been in course of execution during the last two years, and is scarcely yet complete in all respects.

This land is, for the most part, five feet below ordinary spring tides, and certain parts were a complete swamp before the drainage was carried out. Owing to the difficulty of water supply before alluded to, and the consequent necessity of keeping up the level of the water in the ditches, the sluices were at such a level as to render any efficient drainage of the land impossible. Several of these have now been removed, and one main sluice provided at two feet lower level, so that the outlet is now left free for discharge from two to four hours every tide. The level of the water is proposed to be permanently maintained in the ditches at from 4 to 6 feet below the surface. The land drains consist of 2-inch pipes laid 4 feet deep, and from 28 to 35 feet apart. The main outfall consists of 12 and 15 inch pipes laid 6 feet deep. The cost of the drainage has been from 5*l.* to 6*l.* per acre.

It will be gathered from previous remarks that this improved drainage could scarcely be made effectual without some better and more regular means of renewing the supply of water in the ditches, in consequence of the risk of leaving them entirely dry during periods of drought. The foul and stagnant supply kept up for weeks in the ditches without change, was constantly rendered worse for the cattle by the admixture of salt water, which poured in every tide through the leaky and defective sluices.

This latter defect has now been effectually remedied, and, with the view of renewing the supply of fresh water in the ditches, the experiment has been tried of sinking artesian wells at various points over the estate.

These wells consist of simple borings from the surface, lined with 3-inch cast iron pipes. The depths of the wells vary from 120 to 220 feet deep. The water rises to the surface, and is led away in a covered drain to the nearest ditch. Eight of these wells had been sunk, at the time of my visit. They each yield about 2,000 gallons of water per day. Their average cost has been 25*l.* each.

These means must add but little to the renewal of the water supply in the ditches, as I find, on a moderate calculation, that they can effect only one *entire* change of the water in the course of a year; but the idea is a good one, and only requires to be carried out on a larger scale. It is already proposed to sink additional wells of larger capacity, with pipes of 4½ inch wrought iron. These would cost 75*l.* each, but they would be far more economical than those of smaller bore.

The usual rent of the marsh land of Sheppey is 25*s.* per acre Sufficient time has not elapsed to show what increased value will

be realized from the works which have been carried out on the Neats Court Estate; but it is evident that a far less return than that which has followed from similar operations on Rayham Farm would amply compensate for the outlay as a mere money speculation. It would be no hardship, therefore, that the owners of similar lands should be required to carry out similar improvements, and it being known to medical men that the low sanitary condition of the district is entirely due to the state of these properties, there would appear to be every justification for rendering such works compulsory, when it is seen how readily the evil may be removed.

It would not be sufficient, however, merely to call upon each individual proprietor to improve his own estate. A responsible authority is required to see to the safety of the sea walls, to take charge of the sluices, and to regulate the general level of the water. It so happens that the Rayham Farm and Neats Court properties, having sluices of their own, are to this extent rendered independent, but in every case where a proprietor's lands do not extend to the shore line, he would be helpless to carry out the necessary improvements.

The outlets generally are quite insufficient for the improved drainage of the district, and even if complete works of drainage were carried out, an unhealthy condition of atmosphere would still constantly arise, unless efficient control were exercised over the level of the water in the ditches.

There would appear to be upwards of 150 miles length of these ditches in the Isle of Sheppey. There is always a large quantity of rank vegetation in and about them, and constant decomposition must take place therein owing to the ever varying level of the water.

It has frequently been urged that the sanitary and agricultural improvement of districts similar to the Isle of Sheppey, could be effected only by the application of steam pumping power, and by the filling up of the ditches, and substitution of other fences or divisions of properties. I believe that these costly operations are by no means necessary on these marsh lands. That if proper arrangements are made for deepening the outfalls, the effectual drainage of the land may be secured, and if means are at the same time adopted for maintaining the water in the ditches at an unvarying reduced level, and for frequently renewing the supply, I should hope that the opinions of medical authorities will coincide that all danger to health will be removed from these now malarious places.

I have so far confined my remarks to the improvement of the Isle of Sheppey itself, but they will equally apply to the adjacent parts of the country similarly situated, with the exception that in some of these parts the same difficulty will scarcely exist in renewing the supply of water.

I have not thought it necessary for the purposes of this Report to make any extended examination of these surrounding districts. There are about 15 square miles of marsh land southward of the island, divided from it by the River Swale. Upon these lands

Sheppey Marshes.

Mr. Austin's Report.

the towns of Milton, Sittingbourne, and Faversham immediately abut. There is the large district of marshes, ouzes, and saltings extending on both sides of the Medway to Rochester and Chatham, where a large population is exposed to their influence. There is the still more extensive area of marsh land extending northward from the mouth of the Thames to the River Blackwater, but in this immediate district the population, with the exception of the Town of Burnham, is but scanty.

Lastly, there is the most important district of all, on both sides of the Thames, extending from Plaistow and Greenwich to the very mouth of the river, a distance of about 36 miles.

Unlike the Isle of Sheppey, jurisdiction already exists over the marshes of the Thames. These lands appear to cover an area of 32,000 acres, or 50 square miles, and they are under six distinct Commissions of Sewers.

A Select Committee of the House of Commons was appointed in 1854 to inquire into the sanitary and agricultural state of these marshes, the means for their improvement, the existing legal powers for the purpose, and the necessity for further legislation thereon. It was proved in evidence to the satisfaction of this Committee that wherever partial improvement in the drainage of these lands had been effected, not only was a corresponding improvement in the health of the inhabitants perceptible, but that in the words of the Committee's Report, there was "good reason "to believe that the increased value given to the lands by "improved drainage would be such as amply to remunerate the "proprietors for the necessary cost attending such works."

It appeared, however, that "the existing legal powers of the "Commissioners of Sewers are inadequate to effect these objects. "The authority of the Commissioners enables them to maintain "existing works, *but they cannot interfere with the private ditches, "nor can they construct any new works without the previous consent "of three-fourths of the owners and occupiers.*"

I have underlined this latter passage from the Report of the Committee, because under these restricted powers the works hitherto carried out have been of a very partial and imperfect kind, notwithstanding that several large proprietors are most desirous of effecting all the improvements of which the lands are capable. These works are necessarily confined to what each proprietor can do in the way of minor drainage on his own lands, whereas main works of drainage, affecting the lands generally, are essentially required for lowering the outfalls and reducing the water level. And even if these works were accomplished, the improvement would be very incomplete in the absence of a general control over the private ditches, and some regulated means for the supply and discharge of water. For want of this control any proprietor would still have it in his power to frustrate the main advantage of whatever outlay might be incurred for drainage, by damming up the water or suffering its level to be constantly varied according to his own fancy.

The evils arising from the present state of these marsh lands

have been long recognised. Much inquiry has taken place, and the means for the removal of those evils are now so devoid of doubt as to remove all hesitation as to the course to be pursued. All that appears to be required is the simple modification and extension of powers already granted to the Commissions of Sewers. Large proprietors are themselves anxious that these increased powers should be obtained over their lands, and while the sanitary and agricultural improvement of immense districts would certainly be thereby secured, there appears to be no point of countervailing difficulty or objection which would justify further delay.

Sheppey Marshes

Mr. Austin's Report.

In conclusion I beg to submit the following recommendation as the result of my investigations, namely—

That in all districts similar to that of the Isle of Sheppey, where extensive marsh lands cause a malarious atmosphere to which large populations are exposed, powers be sought for securing the execution of drainage and other necessary works, and for providing sufficient control over such lands to guard against the causes of their present unhealthy condition.

V.

Proceedings in reference to the London Sewage Nuisance.

London Sewage.

During the hottest weather of last summer, the West-Ham Local Board of Health communicated to the Privy Council a report recently made to them by Dr. Elliot, their Officer of Health, with respect to the state of the River Lea; alleging that the lower part of this river (which here divides West-Ham from the metropolitan districts, and is furnished with locks under control of the Lea Navigation Company) was rendered offensive and dangerous to the local population by being obliged to receive and retain the great excremental out-flow of the Hackney Brook sewer. A copy of Dr. Elliot's report is (App. No. 4.) appended.

On inquiry it became evident to the Privy Council that these complaints were well-founded; and that the lower part of the River Lea, dammed up by the Navigation Company, and incessantly receiving large infusions of sewage from the Hackney Brook, as well as from its own immediate neighbourhood, was a formidable nuisance to the district. And although a complete cure of the existing evils might not be possible during the present state of the metropolitan drainage, it seemed that, by the following two measures, the nuisance might provisionally be rendered unimportant; viz., first, that the Metropolitan Board of Works should disinfect the Hackney-Brook sewage before its discharge into the

London Sewage.

Lea; and secondly, that the Lea Navigation Company, so long as sewage is received within their locks, should make effectual arrangements for its being discharged with the utmost practicable frequency. With reference to the latter object, the opinion of Mr. Austin, chief superintending inspector under the Local Government Act, was obtained as to the requirements which might reasonably be made of the Company; and a copy of his report is (App. No. 5.) appended.

The Privy Council immediately ordered letters to be written to the Metropolitan Board of Works and to the Lea Navigation Company, with reference to the part which each of these bodies respectively might take in abating the nuisance complained of; and it seems that means with this object were taken by both bodies. But during the above-mentioned proceedings, the greatest heat of summer had passed; and useful results of the inquiry are therefore little to be looked for in any diminution of nuisance then immediately effected. Rather it is to be hoped, that such results will be seen in the summer now approaching; and that a timely adoption of proper precautions by those who are legally responsible for them will prevent even a re-commencement of the nuisances which last year caused so much disgust and alarm.

In connexion with the present subject, it may be proper to state that the attention of the Privy Council has been anxiously given to observe the effects produced on the health of the metropolis, during the heat of summer, by the very fœtid exhalations of the Thames. The subjoined paper communicated by Mr. Ord, represents the best information which has reached the office with reference to this question.

Thames Nuisance.

In July 1858, when the offensive condition of the Thames was exciting considerable alarm among the public, an unusual train of symptoms—occurring in certain captains and others employed upon the river steamboats—attracted my attention.

The attacks began with langour and depression, followed by nausea and headache, particularly severe in the region of the forehead and temples, by aching of the eye-balls, and by a red and swollen state of the throat (erythema). To these were often added giddiness, temporary loss or impairment of sight, the presence of black spots before the eyes, and even utter mental confusion.

None of these men suffered from Diarrhœa.

All were more or less relieved by purgative medicines, whose action was moderate and always under control.

This last circumstance is mentioned on account of the great care usually found necessary in the administration of such medicines during the summer and autumn.

At the instance of Mr. Simon, Medical Officer of the Privy Council, to whom I mentioned these facts, I made wider and more minute inves-

tigations, first in July 1858, and again in July 1859, into the effect of the effluvia upon the health, for the time being, of persons employed on or about the river.

The inquiries were extended to other men working on the steamboats, to the watermen plying at the different piers, to lightermen, and to dock-labourers—nearly 200 men being personally examined.

The same symptoms were found to be very generally prevalent. Here and there a strong young fellow would boast himself free from all discomfort, but, with the exception of five or six such instances, all who were questioned described themselves as suffering from some form or modification of the symptoms above detailed, headache and loss of appetite being almost universal.

Diarrhœa was rare. I could hear of no one being laid up with it, but found that, in certain cases, its occurrence had removed the other class of symptoms, just as artificial purging had relieved those first treated.

A sickness of a kind unknown before to the subjects of it, contemporary with the offensive condition of the river—appearing and disappearring with it, and affecting those only whom chance or their regular occupation exposed to the foul vapours, may with reason be attributed to the action of those vapours.

In the year 1859, the state of the river was at no time equally offensive.

Causes both natural and artificial combined to produce this amelioration.

Less continuous heat of weather, repeated rain-storms, and particular conditions of the tide at the time of these storms, as well as the daily addition of lime to the waters of the chief sewers at their outlets may be cited.

On the renewal of the inquiries, rendered now more complete and extensive by the experience of last year, and the kind assistance of the Secretary to the Thames Conservancy Board, scarcely a trace of the well-marked symptoms of the preceding year was revealed.

Men who had in the year before suffered characteristically, now declared themselves to be feeling quite well—even the appetite remaining unimpaired. A few complained of diarrhœa, though not of sufficient severity to lay up a single man among two hundred watermen in the first week of August.

Watermen are specially mentioned, because the existence of organised societies, called "Turnaway Clubs" at the more important piers, affords a tolerably sound basis of observation. But whether watermen, steam-boatmen, or lightermen were the witnesses, the testimony was always to the same effect, with the only exception that a few who had gone on to the river early in the morning upon empty stomachs had been attacked with retching and headache.

By the kindness of Dr. McWilliam, Medical Inspector to Her Majesty's Customs, I am enabled to add some statistical information with regard to the health of the men employed by the Custom House in July 1858-9.

The total number employed in the waterside and waterguard departments is about 1,500. Of those nineteen came under treatment for diarrhœa in the July of 1858, and Dr. McWilliam noticed several others as suffering from the nervous symptoms already mentioned. In July 1859, thirty-one were treated for diarrhœa, while no complaints of the other class of symptoms were heard.

Comparing the two years, the conclusions, with regard to those employed on or about the river, are—

That in 1858 certain symptoms of a poisoning of the nervous system was present; diarrhœa was comparatively absent, or intercurrent, and curative of the preceding symptoms.

That in 1859 the nervous symptoms were nowhere observed; diarrhœa was more prevalent, but not in a severe form; little illness attributable to the influence of the river existed.

In July 1859 the weekly deaths from diarrhœa had run up to very high numbers, reaching in one week to 412, a larger figure than had been noted in any week before, even during the prevalence of cholera An increase of cases from 19 to 31 is, therefore, rather remarkable for its smallness than indicative of any greater activity of the river poison. At the same time it must be borne in mind that an enormous proportion of the 412 deaths occurred among children, whilst those under our observation are men mostly in their prime.

Hitherto my remarks have related only to those employed on and about the river. With regard to the influence of its emanations upon the health of the metropolis generally, I scarcely venture to form an opinion.

But certainly, in the comparison of the two years, it is evident that the greater amount of weekly mortality in the metropolis has not coincided with the greater development of the stench, our most ready measure of the foulness of the stream.

One is necessarily tempted to make some endeavour toward the discovery of the causes which have led to these conflicting results.

Looking at the symptoms belonging to 1858, we find among them all those which are known by chemists to be produced by an atmosphere containing a certain (differently stated) proportion of sulphuretted hydrogen, while in the absence of diarrhœa we see see evidence of the absence of those subtle organic ferments which are usually supposed to induce it.

In both years the presence of sulphuretted hydrogen in the river atmosphere was shown by the rapid blackening of paper soaked in solutions of lead, and by the discoloration of the paint of vessels. But in 1859, coincident with the extensive disinfecting operations carried on at the mouths of sewers, the stench was much feebler, indicating still the presence of the gas, though not in proportion sufficient to the production of the symptoms.

The origin of this condition may be looked for in the mutual decomposition of the sulphates known to be present in the upward flowing water, and the organic matter of the sewage meeting it. According to the temperature of the water, the impregnation of the atmosphere with the gas would be greater or less.

Lastly, if we find, on the one hand, that the emanations of a river in so foul a state do not actually originate disease,—I do not say how far they may intensify the disease already epidemic,—and, on the other hand, that percolation from cesspools either into the soil or into wells and springs is proved by great masses of evidence to be highly injurious, it seems to me that even this stage in the process of purifying London must be accepted as an improvement upon its previous condition.

The putrefactive matter, instead of abiding in a thousand places as a focus of disease, is brought into one large aggregate, where it may be more readily submitted to disinfecting processes, and where it finds in the water of the receiving stream elements which, if they do not render it less offensive to the senses, appear at least to disarm it of much of its destructive influence.

VI.

Proceedings in reference to the Diarrhœal Districts of England.

Diarrhœal Districts.

In a report* submitted to the late General Board of Health on the eve of its dissolution, attention was drawn to the extreme inequality with which certain fatal diseases prevail in different parts of England. And it was pointed out that the diseases thus unequally prevailing are the diseases which most of all can be prevented.† It was urged, as an almost inevitable conclusion

* Papers relating to the sanitary state of the people of England;—being the results of an inquiry into the different proportions of death produced by certain diseases in different districts of England, by Edward Headlam Greenhow, M.D., with an introductory report by the Medical Officer of the Board on the preventability of certain kinds of premature death, 1858.

† The deaths which occurred during the 7 years 1848–54 in each of 105 separate registration-districts of England, as well as in each of the 11 registration-divisions of the county, and in each of 23 registration-counties, were classed by Dr. Greenhow according to the respective diseases which occasioned them; so as to show, with regard to each given area, how many deaths during the 7 years had been occasioned there by fever, how many by diarrhœa, how many by consumption, and so forth. Then, for purposes of comparison (as the local populations were of various magnitudes) the different local death-sums were all made proportionate to a hypothetical local population of 100,000; and the death-rates thus obtained were used, of course with certain qualifications, as the basis of the above-mentioned argument. The following extract from the summary of results given in the introductory report (p. xxxv.) may serve to show, what alone can here be shown, the extremes of the arithmetical comparison.

(1.) Annual Death-rates by Diseases which are either wholly or almost wholly preventable under good Sanitary Arrangements, have ranged in different Districts as follows:—

Cholera.	Diarrhœa and Dysentery.	Continued Fever.	Small-pox.
From nothing to 403	From 4 to 345	From 21 to 209	From nothing to 146

(2.) Annual

Diarrhœal Districts.

from these facts, "that in certain districts of England, sometimes "by good fortune, sometimes by good local government, definite "causes of disease must have been kept at or near their least "conceivable activity; while in other districts of England the "same causes must have been prevailing with as little check, as "if the community had been one of savages, to whom science "had never taught her first and simplest lessons." It was submitted that all such cases of high special death-rate, as had in the report been referred to, "ought to be thoroughly investigated; "that the local public, and the general public, and the Govern-"ment, and the Legislature, ought to have before them the "precise parts of each case where a preventable, or partly pre-"ventable, disease prevails to great excess in any particular "district." And, with reference to the means for attaining this end, it was observed—"The Public Health Bill, now before "Parliament, will, if it become law, provide for this object. Her "Majesty's Privy Council, empowered to 'cause to be made "such inquiries as they see fit in relation to any matters con-"cerning the public health in any place or places,' will be able "to bring before local authorities, and the people under their "jurisdiction, facts in which the latter are so greatly interested. "The appointed officer will be able to state, not only in such "general terms as have here been employed, but in terms dis-"tinctly applicable to each case investigated, what local evils "have to be removed in order to abate in various districts the "present tenfold or hundredfold multiplication of some prevent-"able disease."

Diarrhœa in its various forms was particularly referred to in the report. And it will be convenient for the present purpose to quote the terms in which that reference was made:—

"*Cholera, diarrhœa,* and *dysentery* have, during the nine years

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(2.) Annual Death-rates by Diseases which to some considerable extent are inevitable, but of which the severity or the frequency may be controlled by good Sanitary Arrangements, have ranged in different Districts as follows:—

Tubercular Phthisis in Women.	Non-tubercular Lung Diseases in Men.	Common Infectious Disorders of Childhood.	Convulsive Disorders of Childhood.	Pulmonary Affections of Childhood.
From 229 to 588	From 66 to 869	From 694 to 2149	From 280 to 3832	From 213 to 2897

" 1848–56, been fatal to 237,498 persons. If this number of " deaths had been equally divided, the annual number would have " been 26,388; but the distribution has been unequal. In the " two years 1849 and 1854 there were 116,246 deaths; in the " two years 1850 and 1855 there were but 29,425, or little more " than a fourth part of the former amount. This inequality " depends on the present tendency of diarrhœal diseases to " prevail in certain years epidemically. A large proportion of " the excess of deaths in 1849 and 1854 occurred during a few " summer weeks, when the epidemic influence was at its height, " and when it occasioned in various parts of the country a very " alarming mortality.

" Diarrhœal diseases, for two reasons, claim particular attention. " In the first place, they are increasing in this country. During " the years 1838–42 the deaths occasioned by them were only " 13 per 1,000 of the deaths from all causes; during the years " 1847–55 their proportion was five times as great. And, in the " second place, their epidemic aggravations are sometimes of " appalling severity. These things are almost forgotten when " they are past; but probably, since the days of the great plague, " death has never so scared an English population as in the " cholera-epidemic of Newcastle in 1853, and in the Golden " Square outbreak in 1854."

" Dr. Greenhow's paper shows that these diseases have pre- " vailed in different parts of the country with an astounding " inequality. The average annual death-rate by cholera has " ranged, from nothing and nearly nothing in some districts, to " 357 and 365 and 403 in others. If cholera alone had shown " this enormous range of difference, it might properly be ques- " tioned whether the history of two epidemics (for the figures are " of course mainly derived from the death-lists of 1848–9 and " 1853–4) is enough to justify generalisations in reference to the " local affinities of a disease apparently so erratic and fitful in " its attacks. Accidental influences might have counted for much " in this restricted experience; and it might be expected that our " next epidemic visitation would do something towards equalizing " the death-rates. No doubt this deserves consideration; most " of all in those places which have hitherto escaped cholera " apparently by no merits of their own. But cholera has not " been alone in showing this great range. Local differences of " death-rate scarcely less wide have been shown by those " diarrhœal diseases which are always present among the popula- " tion. Ordinary diarrhœa and dysentery have ranged in their

Diarrhœal Districts.

" joint average annual death-rate from under 10 in several dis-
" tricts, to 303 and 305 and 345 in others. Or if all diarrhœal
" diseases, epidemic and non-epidemic, be taken together (as Dr.
" Greenhow has taken them) under the single heading of *alvine*
" *flux* the average annual death-rate by this class of disease has
" ranged in different districts, from 4, 8, 10, 14, and 17 in some,
" to 463, 493, 510, 568, and 663 in others.

" It may be imagined that the lowest of these death-rates
" occurs under circumstances of exceptional healthiness which
" cannot generally be realized. So, instead of taking it for com-
" parison (though I do not admit the objection) I will take *ten*
" *times its amount* as my standard.* Let the importance of the
" subject be estimated from one simple statement: — If the
" diarrhœal death-rate of England generally were even *only ten*
" *times* the minimum diarrhœal death-rate, there would be an
" annual saving in England of nearly 20,000 lives.

" Nothing in medicine is more certain than the general mean-
" ing of high diarrhœal death-rates. The mucous membrane of
" the intestinal canal is the excreting surface to which nature
" directs all the accidental putridities which enter us. Whether
" they have been breathed, or drunk, or eaten, or sucked up into
" the blood from the surface of foul sores, or directly injected
" into blood-vessels by the physiological experimenter, there it is
" that they settle and act. As wine 'gets into the head,' so these
" agents get into the bowels. There, as their universal result,
" they tend to produce diarrhœa;—simple diarrhœa in the absence
" of specific infections; specific diarrhœa, when the ferments of
" cholera and typhoid fever are in operation. And any such dis-
" tribution of diarrhœal disease as has just been noticed warrants
" a presumption—indeed, so far as I know, a practical certainty,
" that, *in the districts which suffer the high diarrhœal death-rates,*
" *the population either breathes or drinks a large amount of putrefy-*
" *ing animal refuse.*

" A certain quantity of diarrhœa depends, no doubt, on other
" causes than putrefactive pollution of the system. *Phthisis* not

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* [Since the date of the report, a less arbitrary and yet a stricter standard of comparison has been furnished by Dr. Greenhow, in a paper published by the Statistical Society in their Journal of June 1859. In two considerable groups of contiguous registration districts (one in the north, with an aggregate population of 56,637; the other in the south, with an aggregate population of 183,154) he found the average diarrhœal death-rate to be only 29. If this partial rate were to become general in England (and the districts in which it prevails are by no means so faultless as to be unapproachable) there would occur annually in England about 3 diarrhœal deaths where now there occur about 17; and the annual saving of life would be greater than is spoken of in the text.]

" rarely proves fatal by its effects on the intestinal canal; and " probably a few of these deaths are registered under the name of " the secondary disease. *Temporary faults of diet* very often " occasion diarrhœa, though not often fatal diarrhœa. *Habitually* " *improper food* (especially as regards infants and very young " children) and various other influences contribute to the total of " diarrhœal deaths. But these various causes [so far as they are " of personal origin] operate evenly, or almost evenly, throughout " the country." And where any of them becomes of local importance, — as, where, for instance, in certain manufacturing towns, the constant engagement of mothers away from home in various branches of industry occasions on a great scale the improper feeding of infants and a consequent excess of fatal infantile diarrhœa, this influence, like that of the filthinesses first spoken of, is (the report went on to argue) of an unnatural and removable kind, of a kind against which local arrangements ought directly or indirectly to provide.

On all these grounds it seemed urgent that scientific inquiry should be made into the causes of the disproportionate localisation of diarrhœa in particular districts of England. And if the Privy Council, with respect to initiative action in matters of this kind, had to take for its principle, that it would without solicitation institute local inquiries in cases of excessive preventable mortality, the case of EXCESSIVE DIARRHŒAL MORTALITY seemed particularly fit for a beginning; not only because its causes are for the most part grossly demonstrable; not only because of the popular terror which reigns during its epidemic prevalence as cholera; but at least equally because the endemic causes of diarrhœa are the causes of much other disease. If the diarrhœal death-rate of England is reduced to that which prevails among the healthier part of the population, typhoid fever (now probably the cause of at least 15,000 annual deaths) will be reduced in more than equal measure. And in proportion as infantile diarrhœa is reduced, the convulsive disorders and respiratory inflammations of infancy (which now cause fully 60,000 annual deaths) will also show a very large, if not equal, reduction of death-rate.

Accordingly, with the above facts and arguments submitted, the Privy Council, so soon as authorized by the Legislature,* determined to have inquiry made into the circumstances of those populations among which the diarrhœal death-rate had been highest.

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* The Act of Parliament which continued the functions of the Privy Council in reference to matters of public health became law on August 1st, 1859, and the necessary instructions for this inquiry were thereupon immediately issued.

Diarrhœal Districts.

And, possessed of information which the annexed table* embodies with respect to the registration-districts of Coventry, Birmingham, Wolverhampton, Dudley, Merthyr-Tydfil, Nottingham, Leeds, Manchester, Chorlton, and Salford, selected these places for first inquiry. Dr. Greenhow, hereupon engaged as a temporary Inspector under the Act, was instructed to visit them in succession. And his instructions were to investigate in each place,—first, what was the local distribution of diarrhœal disease; and secondly (so far as was likely to relate to the causation of this disease) what, both generally and with distinction of localities, were the sanitary circumstances of the population.

The results of this inquiry are given in the subjoined reports; copies of which are now being sent by the Privy Council to the several local authorities respectively interested in their contents.

Of these it is not practicable to give any short analysis; except, perhaps, by saying, almost in a word, that from first to last they consistently illustrate the preventability of diarrhœal death.

One illustration of this fact, belonging to almost all the districts, may be quoted with satisfaction. Generally in them, it seems, there has been for several past years a growing, though

*Yearly Number of Diarrhœal Deaths (Diarrhœa, Dysenteny, and Cholera) in the several under-mentioned Registration Districts.

	Registration Districts.									
	Coventry.	Birmingham.	Wolverhampton.	Dudley.	Merthyr Tydfil.	Nottingham.	Leeds.	Manchester.	Chorlton.	Salford.
Population in 1851.	36,812	173,951	104,158	106,530	76,804	58,419	101,348	228,433	123,841	87,523
Year.	Diarrhœal Deaths.	Diarrhœal Deaths.	Diarrhœal Deaths.	Diarrhœal Deaths.	Diarrhœal Deaths.	Diarrhœal Deaths.	Diarrhœal Deaths.	Diarrhœal Deaths.	Diarrhœal Deaths.	Diarrhœal Deaths.
1848	79	440	122	240	51	58	243	644	387	224
1849	305	464	1,615	682	1,779	125	1,770	1,791	656	514
1850	67	444	130	174	75	91	204	678	312	192
1851	191	480	190	250	125	140	294	494	258	191
1852	163	511	272	262	124	128	386	937	416	368
1853	121	394	196	214	117	129	270	543	236	243
1854	180	610	372	614	581	179	331	728	348	352
1855	60	308	133	187	93	66	148	449	200	189
1856	77	358	199	208	65	92	184	492	252	203
1857	158	609	285	348	114	221	258	695	321	269
1858†	61	352	151	208	78	169	251	472	162	226

† The numbers for this year were only obtained during the inquiry.

still insufficient, perception of the importance of cleanliness:—in all, it seems, something, though far from enough, has been done for sanitary improvement; in some cases, structural deficiencies have been partly supplied; and probably in all cases greater attention has been given to scavenging and other such removal of filth. Except in one town (where well-intended, but ill-devised, endeavours to increase the privy accommodation of the poorer classes have unfortunately been productive of mischief) the local prevalence of diarrhœa has in consequence been reduced. The annexed table* compendiously shows the particulars of this reduction.

On the other hand, it must not be concealed that, though a beginning has been made, a vast deal remains to be accomplished. Even those improved death-rates, which are shown in the 1854-58 column of the table, are very greatly in aggravation of what is due.

There are *districts of England in which endemic diarrhœa is unknown.* There are *extensive groups of districts* where (as the last line of the table shows) the *habitual death-rate from diarrhœa does not attain 30;* and even in these districts the existing diarrhœa is assuredly much beyond what it would be if

*Average Annual Number of Diarrhœal Deaths in proportion to each 100,000 living.

Population in 1851.	Registration Districts.	Diarrhœal Deaths. During the Years 1848–1854.	Diarrhœal Deaths. During the Years 1854–1858.	Exclusion of Deaths as below, which were ascribed to Epidemic Cholera.
36,812	Coventry - -	350	266	202 cholera deaths in 1849 excluded.
173,951	Birmingham -	274	233	The few cholera deaths which have occurred (only 99 in the 11 years) are *not* excluded from the calculation.
104,158	Wolverhampton -	210	193	1,346 cholera deaths in 1849 excluded.
106,530	Dudley - -	237	221	412 cholera deaths in 1849, and 256 in 1854, excluded.
76,804	Merthyr Tydfil -	135	106	1,683 cholera deaths in 1849, and 455 in 1854, excluded.
58,419	Nottingham -	208	234	The few cholera deaths which hav occurred are *not* excluded from the calculation.
101,343	Leeds - -	291	217	1,436 cholera deaths in 1849 excluded.
228,433	Manchester - -	320	228	891 cholera deaths in 1849 excluded.
123,841	Chorlton - -	270	165	279 cholera deaths in 1849 excluded.
87,523	Salford - -	303	255	234 cholera deaths in 1849 excluded.
239,791	Standard Districts of England during the years 1847–1855	29		

Diarrhœal Districts.

cleanliness were in all cases duly cared for. It is therefore nothing unreasonable, to take their death-rate as a standard for comparison. Tested by this standard, the districts now reported on show, even in their ameliorated state, an extravagant mortality from diarrhœa, —a mortality which is from $3\frac{1}{2}$ to 9 times as high as that of the districts here contrasted with them. It is, therefore, greatly to be hoped, that, by the information now collected and communicated, the respective local authorities in these several districts will be induced to apply with increased vigilance the means which are necessary for removing from their administration the reproach of preventable, but unprevented, disease. And in this respect, one paragraph from the following paper,—a paragraph which expresses the most definite result of Dr. Greenhow's observations in all the diarrhœal districts, and which accords with all the best experience previously obtained in other like investigations, deserves to be well remembered:—

"The excess of mortality has in all the places been coincident with one or other of two definite local circumstances;

(*a*) the tainting of the atmosphere with the products of organic decomposition, especially of human excrement,—or

(*b*) the habitual drinking of impure water."

It also deserves to be remembered, both by the local authorities of these districts, and even more by the great manufacturers whose unparalleled wealth is acquired in them, that the extensive factory-employment of female labour is, unless care be taken to avert its effects, a sure source of very large infantile mortality, both diarrhœal and convulsive; that where mothers are engaged in factories, infants who should be at the breast are commonly ill-fed or starved, and have their cries of hunger and distress quieted by those various fatal opiates which are in such request at the centres of our manufacturing industry; and that the labouring classes themselves have not the power of organizing such arrangements as might at least greatly mitigate this evil.

Dr. Greenhow's Reports on the Prevalence and Causes of Diarrhœa at Coventry, Birmingham, Wolverhampton, Dudley, Merthyr-Tydfil, Nottingham, Leeds, and Manchester with Chorlton and Salford.

Diarrhœa in Coventry.

Dr. Greenhow's Report.

Coventry.

Exclusive of 202 deaths from epidemic cholera in the year 1849, the deaths from diarrhœal disease in Coventry, that is to say from diarrhœa, summer cholera and dysentery, during the eleven years 1848 to 1858, amounted to 1,260. The cholera epidemic of 1853–4, which was severe in certain districts of England, fell lightly upon Coventry, only nine deaths being attributed to that disease in the death registers of those years. The mortality from diarrhœal disease was considerably higher than the average in the year 1854, but notwithstanding the existence of an epidemic of cholera, in other parts of the country, was smaller than that of 1851, and very little exceeded that of 1857. The exact number of deaths from diarrhœal disease, including summer cholera, in each of the three years, was 191 in 1851, 180 in 1854, and 158 in 1857. Dividing the above-mentioned eleven years into two unequal periods, each including the year 1854, and consisting of seven years and five years respectively, the average annual number of deaths was 129 during the earlier, and 107 during the later, period.

Diarrhœal mortality.

The population of Coventry in 1851 was 36,812, and if it has increased in the same ratio since the census of 1851, as it increased between the years 1841 and 1851, it would, in 1856, consist of rather more than 40,000 persons. The year 1851 is the middle year of the seven years 1848–54, and 1856 is the middle year of the five years 1854–58. If these numbers—the actual population of 1851, and the estimated population of 1856—be employed for calculating the rate of mortality in the two periods of seven and five years already mentioned, the annual average proportion of deaths from diarrhœal disease in Coventry was at the rate of 3·50 per 1,000 persons during the seven years 1848–54, and 2·66 during the five years 1854–58. The latter period includes the two epidemic years 1854 and 1857, and the former the three epidemic years 1849, and 1854; but as the deaths from cholera in 1849 have been excluded from the calculation, the diarrhœal mortality of that year, being under the average, does not raise the rate of mortality in the earlier period. It thus appears that the diarrhœal mortality of Coventry has of late been on the decrease, a circumstance probably to be ascribed to the local improvements which have been very actively carried out by the civic authorities during the last few years, and which are still in progress. The city has been thoroughly drained; the streams which pass through it, formerly in a very foul condition, and used as receptacles for refuse by the inhabitants upon their margin, have been purified, and measures adopted to prevent, as far as possible, their defilement in future. According to a state-

Population and rate of diarrhœal mortality.

Description of district.

Improved state of Coventry.

Diarrhœa in Coventry.

Dr. Greenhow's Report.

ment of Mr. Webster, the local inspector, upwards of 200 privies, which formerly emptied themselves into the river, have been removed. A great number of cesspools have likewise been abolished, water-closets being for the most part substituted in their place. Formerly wholly dependent for water upon the wells attached to private dwellings, and upon the public pumps, (twenty-one of which still remain in the public thoroughfares,) the inhabitants of Coventry now obtain this necessary of life chiefly, but not quite exclusively, from the public water-works; the old private wells and public pumps being still partly in use in a few localities. Several of these improvements are of too recent a date to have as yet produced their full influence upon the public health.

Analysis of public water.

Samples of the public water taken from the reservoir with the requisite precautions, on August 20th, were, in accordance with directions given at the commencement of the inquiry, transmitted the same day to Professor Miller, of King's College, for examination. Dr. Miller reports that the water is calcareous, of low hardness, and fairly free from organic impurity.

Analysis of Water from Reservoir, Coventry.

Hardness before boiling (Clark's scale) -	10°·9
Hardness after boiling one hour - -	3°·7
Specific gravity - - - -	1000·18
Solid contents in grains, per imperial gallon:—	
Fixed salts - - - -	17·76
Volatile and combustible matter -	1·44
Total solid matters - - -	19·20
Nitric acid - - - - -	0·16
Ammonia - - - - -	0·86
Cubic inches of gas per gallon:—	
Carbonic acid - - - -	9·13
Oxygen - - - -	1·65
Nitrogen - - - - -	4·44
Total quantity of gases in solution -	15·22
Proportion of oxygen to nitrogen - -	1 : 2·68

Rate of general mortality.

In addition to the decrease of diarrhœal mortality, there has likewise been a diminution both in the mortality from all causes, and also in the mortality from fever, in Coventry, during the five years 1854–58 as compared with the seven years 1848–54. The mortality from all causes during the seven years 1848–54 was at the average annual rate of 27·17 per 1,000 persons. During the five years 1854-58 it has only been 25·04 per 1,000 persons. Fever was, on the average, fatal at the rate of 1·35 persons per 1,000 during the seven years 1848-54; it has only been fatal at the rate of 1·09 persons per 1,000 during the five years 1854-58.

Diarrhœa in Coventry.

Dr. Greenhow's Report.

Density of building.

It should here, perhaps, be mentioned that Coventry possesses several local advantages likely to conduce to the success of measures designed for its sanitary improvement. The city is slightly elevated, and its site is by no means densely covered with buildings; there is much open ground, so that many courts occupied by the labouring classes and factory operatives either have gardens in their centre, or are open to garden ground at the further end. From this character of Coventry, although the population is almost exclusively urban, the inhabitants are aggregated upon the surface of the earth at the rate of only 4,292 persons on the square mile. The common lodging-houses excepted, very few of the dwellings contain more than one family, and the custom of letting out single rooms for the occupation of a family, so common in London and some of the larger provincial towns, is at least very rare in Coventry.

Division into Heads.

The deaths from diarhœa during the five years, 1854–8, included in the present investigation, have been unequally distributed as respects,—

a, the different years of the period;
b, the different seasons of the year;
c, the several stages of life; and
d, the different parts of the city.

Mortality in different years.

a. There were decided epidemics of diarrhœa in the years 1854 and 1857; the number of deaths in each of these years being more than double that of the years 1855, 1856, and 1858. The exact number of deaths in each of the eleven years 1848-58, is shown in the subjoined table:—

1848	79	1854	180
1849*	103	1855	60
1850	67	1856	77
1851	191	1857	158
1852	163	1858	61
1853	121		

Mortality in different months.

b. Two-thirds of the deaths during the five years 1854-8, more particularly referred to in this inquiry, occurred in the months of August, September, and October. Supposing the deaths from diarrhœal disease during the five years to have amounted to 1,000, their distribution among the several months of the year would be shown in the subjoined table:—

January	29·5	August	227·1
February	32·9	September	263·4
March	31·2	October	157·7
April	43·3	November	38·2
May	29·4	December	27·8
June	39·8		
July	79·7		1000·0

* Exclusive of 202 deaths from cholera.

Diarrhœa in Coventry.

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Mortality at several periods of life.

c. The deaths have been very largely those of young children—more than half of them having occurred to infants under one year, and more than four fifths to children under five years of age. Supposing the deaths from diarrhœal disease during the five years to have amounted to 1,000, their distribution to the several stages of life would be shown in the subjoined table:—

Under 1 year of age - - -	676·0
Between 1 and 5 years - - -	176·7
Between 5 and 60 years - -	69·3
Over 60 years - - -	78·0
	1000·0

The proportion of infant deaths to the total mortality from diarrhœa varied in different years; 65 per cent. of the diarrhœal deaths of 1854 were those of children in the first year of life; the proportion varied very little in the years 1855, 1856, and 1857, being about 69½ in the two former and 71½ per cent. in the latter of those years. In 1858 it was only 61½ per cent.

Local distribution of diarrhœal mortality.

d. The fact that very few of the houses of Coventry contain more inmates than the members of a single family, renders it possible to estimate the population of smaller districts with some approach to accuracy, and by the aid of this estimated population to calculate their diarrhœal death rates. A return showing the number of dwellings in each street of Coventry was very obligingly furnished by Mr. Greatorex, the city surveyor, for this purpose.

The places in the subjoined table, have been selected to illustrate the very different amount of diarrhœal mortality in different parts of the city of Coventry, chiefly because the number of diarrhœal deaths from year to year in each of them has been tolerably uniform, but also because of the remarkable diversity of their death-rates, which have been worked out in the usual manner. The districts are likewise in other respects suitable for comparison, and the facts, upon which the comparison is founded, are trustworthy.

Table showing the rate of diarrhœal mortality in certain districts.

Name of District.	Average Annual Number of Deaths per 1000 Persons.
St. John Street - -	1·5
Union and Thomas Streets -	2·0
Swanswell Street, &c. - -	2·3
Sherborne Street and Spon-End -	2·7
West Orchard - -	3·3
Much Park Street - -	4·0
Gosford Street - - -	4·1
Spon Street - -	4·2
Well Street - - -	7·3
Coventry - - -	2·6

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Normal rate of death from diarrhœa.

It is evident from the above table that the proportionate amount of diarrhœal mortality varies much in different parts of Coventry. Making ample allowance for the errors, which cannot be entirely avoided in estimates like the present, diarrhœa is twice, and sometimes thrice, as fatal in certain parts of Coventry as in others. In two extensive rural districts of England, the smaller of which contained in 1851 a population of 56,637 persons sparsely scattered over an area of 1,256 square miles, and the larger a population of 183,154 persons distributed over an area of 1,449 square miles, the average annual mortality from diarrhœa during the nine years, 1847-55, was at the rate of less than 0·3 per 1,000 persons.* Compared by this standard the diarrhœal mortality of Coventry is greatly in excess of the normal rate, even that of the healthiest district in the above table, being five times larger than it ought to be. There must, therefore, be some cause common to the entire city of Coventry, which renders its inhabitants unusually liable to death from diarrhœa. On the other hand, it may be presumed that local causes exist in the more unwholesome districts shown in the above table, from which the healthier streets are exempt. The several streets mentioned in the table, as well as some others not included in it, were minutely investigated, with a view to discover these causes. The investigation had reference especially to the nature and source of the water drunk by the inhabitants, and to the presence or absence of organic impurities, causing atmospheric contamination; but the diet and habits of the people and the condition of their dwellings were not overlooked. The results of that investigation here follow in the order in which the streets are placed in the above table.

St. John's Street.

St. John's Street is rather narrow, and contains 16 courts. The water supply is derived chiefly, perhaps exclusively, from the public waterworks. Most of the houses and courts have gardens, and where there are not waterclosets, the privies are usually at some distance from the dwellings. The only exceptions to the otherwise satisfactory condition of this street are found in courts No. 4 and 5, which are imperfectly ventilated and have privies nearer the houses, and in court No. 22, which contains a foul privy in one corner close to a house, every inmate of which has suffered from diarrhœa.

Union and Thomas Streets.

Union and Thomas Streets are well conditioned streets, inhabited chiefly by artizans and operatives; one outlet of each opens into Butt's Lane, opposite the open country, and they are here dealt with together, because they adjoin each other and are almost similar in character. Both the streets themselves and the adjoining courts are drained. The water supply is derived from the public works, and the houses are provided with either privies or waterclosets, not one of which was alleged to be a nuisance. In several of the courts are garden plots, some of which are very tastefully tended. Besides the public water, which is supplied to all the courts, there are several private pumps, the water of which was said and really

* Journal of Statistical Society of London, June 1859, pp. 256 and 261.

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appeared to be of excellent quality. The situation of the private wells in these streets is such, that contamination of the water, by the percolation of sulliage or other impurities, is at least unlikely.

Swanswell Street.

Swanswell Street, Primrose Hill, Yardley, Canterbury, King William, Adelaide, and Church Streets are near to one another on the outskirts, and on the opposite side of the city to Thomas and Union Streets. The inhabitants of these streets are chiefly factory operatives and artizans, who are for the most part in comfortable circumstances; the streets themselves are in good condition, and the courts connected with them are almost invariably paved and drained, are usually spacious and airy, and sometimes have garden ground in the centre. The water-supply is obtained partly from the public works, partly from wells on the premises, but the two modes of supply are so intermixed as to render a distinct classification of the streets according to the source of water supply most difficult. Sometimes, both kinds of water are met with in the same court, but more frequently, where the well water is useable, the public water is not taken in. Some of the well water was not quite above suspicion; but more generally the wells are so situated as to render contamination of their water improbable. Pigs are kept in a few of the larger courts, but rarely in the immediate neighbourhood of dwellings. Water-closets or privies are provided in all the courts, the latter being in every case sufficiently distant from the houses to prevent danger from their exhalations. Cases of diarrhœa were heard of occasionally, but much less commonly than in several of the streets to be presently referred to.

Sherbourne Street.

Sherbourne Street and Spon End, including Spon Causeway, are well-conditioned airy places at the further end of Spon Street, near to each other and to the open country.

West Orchard.

West Orchard is a long narrow street, said to have formerly been in a wretched condition. Mr. Barton, one of the Union medical officers, says that diarrhœa used to prevail to a great extent in this street; the same assertion was likewise made by Mr. Bicknell, another medical practitioner, to the inspector who conducted the preliminary inquiry in 1849, previous to the application of the Public Health Act to Coventry. The street was subsequently drained and otherwise improved, and the River Sherbourn, which flows near to it, cleansed. The public health of the street and adjoining courts is said to have greatly improved since these alterations, the prevalence of diarrhœa in particular being much diminished. This district holds an intermediate position, as regards the rate of diarrhœal mortality, between the healthiest and most unhealthy streets of Coventry. It is closer and more densely occupied than the several streets already described and even than some of those which hold a lower place than itself in the scale of salubrity.

Much Park Street.

Much Park Street is open and airy, contains some houses of a better description, together with about 40 courts, inhabited by the poorer classes, and frequently entered from the street through narrow arched passages. Almost all the houses and courts in this street have water laid on from the public works, but there is also

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a public pump still in partial use. A few of the courts are narrow and imperfectly ventilated, but the majority are airy and open at the further end upon gardens or other unoccupied ground. A few of the courts are provided with waterclosets, the remainder with privies, which are usually well apart from the houses. It is said there was formerly much sickness in the street which was at that time in bad order, the privies being much neglected and highly offensive, and there being no drainage. The more objectionable of the privies have been removed, waterclosets being substituted, and nearly every court has been drained. An inhabitant of the street for the last thirty years said it is now greatly improved and much healthier, a statement confirmed by several other individuals who have resided there for shorter periods. Cholera prevailed in this street in 1849, especially in court No. 3, which has been widened by the removal of a block of houses, and otherwise improved since that time. Although inquiry was made in all the courts, the existence of diarrhœa within the last two years was only discovered in four of them. It is noteworthy that these four are the only courts in the street in which any obvious nuisance or defect of construction, likely to induce atmospheric contamination, was observed. The ventilation of one of these courts, No. 33, is rendered most defective by the high blank wall of a factory blocking it up in front, so that, although the privies are apart from the houses, there is danger of the effluvia proceeding from them infecting the atmosphere. In the other courts referred to, the privies have either been built against houses, as in court No. 27, or are so situated as to be offensive to the inmates of the neighbouring houses, as in court No. 21.

Gosford Street.

Gosford Street, and most of the 43 courts which communicate with it are drained, and have been much improved within the last, two years. The courts are mostly in good condition, open, airy, and often have garden ground at their further end. The street and courts are well supplied with water, chiefly from the public waterwoks, but partly also from private wells which are still in use in a few places, and from two public pumps in the street. There is either a privy or a water-closet in every court. So far as the local history of diarrhœa could be traced in this street, from the evidence of the inhabitants, this disease has prevailed during the last two years almost exclusively in courts where there are privies or other sources of offensive effluvia in the neighbourhood of houses. It was clearly ascertained that diarrhœa has prevailed more or less in seven courts. In six of these courts the dwellings of persons who have suffered from the disease were exposed to one or other of the above-mentioned causes of atmospheric impurity; no cause of such impurity was discovered in the seventh court, but the only source of water supply was a well in the court, which was dry at the time of inspection, and the public pump in the neighbouring street. The six courts were, with four others not hitherto referred to, the only ones in the street in which nuisances were observed. In two of the four last-mentioned courts the population was of so migratory a cha-

Local conditions producing diarrhœa.

Diarrhœa in Coventry.

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racter that no reliable evidence could be elicited from the inhabitants; a third was a filthy court, where the privies were foul and pigs were kept, but it was said by the inhabitants to be healthy; the fourth court, in which cholera is said to have occurred in 1849, and fever to have sometimes prevailed, has privies so situated between adjoining houses that they cannot fail to be a nuisance, yet it could not be discovered, from inquiry of the inhabitants, that diarrhœa has prevailed at any recent date. In court No. 11, being one of the six courts already mentioned, diarrhœa prevailed in only two houses which are near to the privies, and are the only ones in the court which could possibly be affected by their exhalations. In one of these houses every inmate had repeatedly suffered from diarrhœa, which had also prevailed to a less extent in the other house which is more distant from the privy. The other families in the court, one of which had resided there five years, had entirely escaped. The court is spacious and in good condition, and the water supply is from the public waterworks. In court No. 14 the privies are at a proper distance from the dwellings, but smells proceeding from a slaughter-house and other nuisances at the bottom of the court were complained of by the inhabitants, several of whom have from time to time suffered from diarrhœa. The privies of court No. 44, which was in other respects in good order, were a source of annoyance to three families, one of which had resided 40 years, another three years, and the third four months, in the court. Diarrhœa has occurred in all the three houses, though in that of the oldest inhabitants not recently. Of the family which has resided in the court three years every member has suffered annually from diarrhœa, since coming here, the husband at least having previously been free from it; the house overlooks the privy. Four cases of diarrhœa had already occurred in the third family during their four months' residence in this court; the house in which they live is situated close to the privy. Noisome smells are said to have existed in court No. 34 previous to its being drained. One family of 13 years standing in the court has on three different occasions been attacked by fever attended with diarrhœa, three or four of its members having been down with it on each occasion; diarrhœa and fever have also prevailed in the neighbouring houses from time to time, and cholera appeared in the court in 1849. The houses are old, and the rooms low, and the population so migratory that trustworthy information could only be obtained from the older inhabitants.

Court No. 4, Gosford Street affords an illustration of the good effect of free ventilation in dispersing and rendering harmless exhalations which, under different circumstances, might prove injurious. In this respect it forms a striking contrast to court No. 33, in Much Park Street, already described, where the existence of a high wall, impeding ventilation, confined and concentrated the effluvia from privies which, under other circumstances, might have been harmless. Court No. 4 was in a very good sanitary state at the time of inspection; but this was only of recent origin, for

both the local inspector and the inhabitants represented it as having been in a very bad condition. A large garden adjoins the court, which renders it very airy, and persons who had lived in it several years asserted that, notwithstanding its former foul condition, diarrhœa was unknown among the inhabitants. The remaining courts in Gosford Street were all in satisfactory condition, and in none of them was it ascertained that diarrhœa had prevailed. Indeed, the evidence derived both from personal observation and inquiry in this street pointed to the conclusion that where local nuisances, especially foul privies contaminating the atmosphere, existed, diarrhœa had been more or less prevalent; but that this disease had been almost, if not altogether, absent from better conditioned places.

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Spon Street is clean, spacious, and well kept; it contains many houses of the better class and about 50 courts, all in excellent condition. The water supply is chiefly derived from the public waterworks, but likewise partially from wells, which there is no reason to suppose bad. The courts are in general well ventilated, frequently have garden ground attached to them, and are sometimes open to the country. In fact, the street has rather the character of a country road lined with houses, having courts behind them, than of a street in a city. Mr. Barton, one of the Union medical officers, who resides in the street, says that nuisances, such as foul privies and piggeries, were till recently rife, and that diarrhœa and fever were then very prevalent. These diseases have greatly decreased in frequency since the local improvements were introduced: yet, although this now appears to be one of the best streets in Coventry, the mortality from diarrhœa during the last five years, in proportion to its population, has been considerably higher than that of the entire Registration district. Fever has produced a mortality in Spon Street, at the annual rate of 1·5 per 1,000 persons during the last five years.

Spon Street.

Well Street runs parallel for some distance to the Radford Brook which, so recently as two years ago, received the soil from nearly all the privies on one side of the street. This brook, which is often shallow and was very foul, has been lately cleansed; many of the privies have been converted into waterclosets, the soil from which is not conveyed into the brook, but into a common sewer; the soil from the remaining privies is now received into cesspools. Some of the privies continue to be a nuisance in small and ill-ventilated courts, this being a much more densely built district than any of those formerly described. There is in this street a public pump which formerly supplied the inhabitants of a considerable and densely peopled part of Coventry with water, and which is still used by the inhabitants of the surrounding houses. The water from this well is bright, and is, as I can vouch from personal experience, palatable, cool, and refreshing in hot weather. Nevertheless, as diarrhœa has been more prevalent in this than in any other street of Coventry, and as at least one-fifth of the deaths from cholera in 1849 occurred therein a sample of the water

Well Street.

Impure water a cause of diarrhœa.

Diarrhœa in Coventry.

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was taken on August 26, and transmitted to Professor Miller, of King's College, for examination. From the subjoined analysis made by that gentleman it will be seen that this favourite and agreeable water, for such it was declared to be by the people of the neighbourhood, is unfit for domestic use.

Analysis of water from Well Street pump.

Analysis of Water from the Pump in Well Street, Coventry.

Hardness before boiling (Clark's scale) -	46°·8
Hardness after boiling one hour - -	22°·8
Specific gravity - - - -	1001·34
Solid contents in grains, per imperial gallon :—	
Fixed salts - - - -	81·36
Volatile and combustible matter - -	2·32
Total solid matter - -	83·68
Nitric acid - - - -	1·33
Ammonia - - - -	0·561
Cubic inches of gas, per gallon :—	
Carbonic acid - - - -	25·35
Oxygen - - - - -	1·14
Nitrogen - - - -	4·38
Total quantity of gases in solution -	30·87
Proportion of oxygen to nitrogen - -	1 : 3·84

It is very hard, contains alkaline salts, is largely loaded with ammonia and nitrates, and is very imperfectly oxygenated.

Some of the courts in Wells Street have now the public water laid on, but the majority of the inhabitants are still dependent, either upon the above-mentioned public pump or upon private wells for their water supply. The latter are usually shallow and by no means free from the danger of contamination from the drains or cesspools. Well Street has been very much improved during the last two years, and several of the older inhabitants said that diarrhœa, which was formerly very prevalent, has been much less frequent since the improvements.

Some facts relative to other parts of Coventry deserve to be recorded, although for various reasons it has not been deemed possible to calculate their rate of mortality from diarrhœa in a trustworthy manner.

Palmer Lane.

Palmer Lane is a narrow, dirty, ill-kept street, and the worst conditioned in Coventry; the courts, five in number, are confined, ill ventilated, and filthy; the population is squalid, a large proportion of it consisting of the lower order of Irish, who are usually dirty in personal habits, and engender filth wherever they congregate. The privies in Palmer Lane were in almost every instance in a foul condition, and sometimes were placed in close proximity to the dwellings; pigs were kept in several of the courts; in two of the courts are slaughter-houses, and in a third there was, at the time of inspection, a large heap of stinking

manure. The soil of all the courts is saturated with filth. Bad as is the present condition of this street, it is represented as being in a much better state than formerly. Several houses have been pulled down, and the courts have been partially opened out by the removal of ruinous buildings, so as to improve the ventilation, On this account, and because some of the houses are let out in single rooms, the mode employed for computing the population of some of the other streets of Coventry is not applicable to Palmer Lane. There has been considerable mortality from diarrhœa in the street which, if seven persons be allowed for each house now standing, would exhibit an annual death-rate of 5·5 per 1000 persons for the last five years.

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Grove Street, a short street in bad order, contains too small a population to admit of reliable statistical investigation, but it confirms the impression which the history of other portions of Coventry conveys, that both air, contaminated by the exhalations from privies, and the ingestion of impure water are causes of a high diarrhœal mortality. In court No. 2 of this street is a pump, the water of which is exclusively used by at least ten families; the privies, which are at the back of the court and said to be sometimes offensive, are at a satisfactory distance from the dwellings; the court is tolerably spacious and well ventilated, yet diarrhœa has been very prevalent among the inhabitants. Every member of one family, which has been resident here nine years, has suffered from diarrhœa, which has proved fatal to two of the children. Two children of another family, living in the same court, died of diarrhœa last year, and cases have occurred in all, or nearly all, the houses. The people themselves attributed the prevalence of this disease to the water of the pump, which they alleged to be impure; a sample was accordingly transmitted, on August 26, to Professor Miller, whose analysis is here quoted:—

Grove Street.

Impure water a cause of diarrhœa.

Analysis of Water from the Pump in Court No. 2, Grove Street, Coventry.

Analysis of water from Grove Street.

Hardness before boiling (Clark's scale) -	64°·8
Hardness after boiling one hour - -	51°·6
Specific gravity - - - -	1001·47
Solid contents in grains, per imperial gallon:—	
Fixed salts - - - -	105·04
Volatile and combustible matters -	5·68
Total solid matters - - -	110·72
Nitric acid - - - -	11·63
Ammonia - - - -	0·13
Cubic inches of gas, per gallon:—	
Carbonic acid - - - -	19·82
Oxygen - - - -	1·05
Nitrogen - - - -	5·22
Total quantity of gases in solution	26·09
Proportion of oxygen to nitrogen - -	1 : 5

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The water is very hard, contains alkaline salts in abundance, is largely loaded with ammonia and nitrates, is imperfectly oxygenated, and unfit for domestic use.

In the centre of court No. 1, Grove Street, was a large manure heap, from which as well as from the privies issued foul and offensive exhalations. The court is closely hemmed in on three sides by houses, its ventilation is most imperfect, and diarrhœa has prevailed much among the inhabitants.

Mill Lane.

Mill Lane.—Court No. 1 affords a further illustration of the apparent connection between filth of locality, diarrhœa, and fever. The water supply of the court is obtained from the public waterworks, but there is a privy which is said to have been habitually foul, and to be intolerably offensive in hot weather. Typhoid fever and diarrhœa have been so prevalent, that every member of three several families has suffered from one or both of these diseases during the period of their residence in this court.

Far Gosford Street.

Far Gosford Street, Rowe's Yard, contains two houses. which have very foul privies in a confined yard behind them. All the inmates of one of the houses have had repeated attacks of diarrhœa, of which complaint one child has died; they have resided eight years in the house. Of four inmates of the adjoining house, two have suffered from diarrhœa within the last two years. Both houses are supplied with water from the public waterworks.

Conclusions.

Local conditions producing diarrhœa.

From the above history of diarrhœa in Coventry, it is evident that the drinking of impure water, and exposure to an atmosphere infected with the products of fæcal decomposition, must be reckoned among its principal causes. The former is proved by the excessive mortality which has occurred in districts like Well Street and Grove Street, where the water habitually used by the people for diet is shown by Professor Miller to contain organic impurities; the latter by the larger proportion of deaths in streets which, like Gosford Street and Much Park Street, abound more or less in foul privies, each a focus of atmospheric contamination, around which cases of diarrhœa appear to congregate. And this evidence receives additional confirmation from the comparative immunity of certain districts, such as St. John Street and Thomas and Union Streets, which, except being exempt from the effluvia of privies and from impure water, are in all respects similar, and inhabited by a similar population to the more unhealthy places. But the immunity even of these better conditioned districts of Coventry is only comparative, for the rate of mortality in them is much higher than that prevailing in healthy places, and the medical men unanimously agreed that diarrhœa is more or less common in every part of the city.

Other causes of diarrhœal disease, which, as they are common to all the districts included in my investigation, will be best noticed in a general summary at the end of the paper, are what the elder physicians would term the epidemic constitution of particular years and the influence of season; diarrhœa, as has been shown, having been the most fatal in certain years and during the autumnal months.

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Large mortality of infants.

Alleged causes.

But as the epidemic constitution of the year and the influence of season are common both to Coventry and to places where the mortality from diarrhœa is inconsiderable, we must seek for other causes of its prevalence in the latter city. A very large proportion of the deaths from diarrhœa in Coventry have been shown to be those of infants under the age of one year. It is true, the same may, perhaps, be said of every district where diarrhœa is a prevalent cause of death, but the proportion is unusually large in Coventry. Several causes for this were assigned by the medical men, and chiefly, the improper feeding and neglect of infants consequent upon a very large proportion of the mothers being employed in factory labour, the system of drugging children with Godfrey's cordial, and the habit of procuring medicine from druggists, and of not calling in proper medical aid until a case has become hopeless. This is said to arise from the circumstance, that any freeman having recourse to the Union surgeon for medical advice is deprived of his vote for a year. Hence, as persons of this class either cannot afford or are unwilling to pay a private practitioner for his services, they only apply to one in the last extremity. Since the pernicious custom of administering Godfrey's cordial to restless infants, and of applying to druggists for medicine instead of to properly qualified medical practitioners are rather indications of the existence of disease than its origin, by far the most influential of the assigned causes is the very extensive employment of women in factories. Accustomed from girlhood to work in factories, the female operatives of Coventry are often deficient in the housewifely attributes of their sex, and are but bad managers of their infants. Mothers commonly leave their babes when not more than from three to five weeks old to the care of little children or of hireling nurses, and are unable to suckle them oftener than twice between going to the factory in the morning and returning at night. Hurrying home, heated, to breakfast at 8 o'clock A.M., and again at 1 P.M. to dinner, the mother has to nurse her child and get her own food within the brief space of time allowed for these meals. During her absence the child is fed on diet unsuited to its digestive organs, most commonly on bits of bread soaked in warm water sweetened with sugar, more rarely on some kind of farinaceous food. This system of rearing infants came prominently under observation in the course of the present inquiry, and is, beyond all doubt, a most influential cause of the high mortality of children in Coventry: a mortality which no exclusively sanitary improvements will entirely remove.

Birmingham.

Birmingham.

Diarrhœal mortality.

In the successive epidemic outbreaks of 1832, 1848–9, and 1853–4, cholera caused a very inconsiderable mortality in Birmingham. Not more than 99 deaths from this disease are recorded in the death registers for the seven years 1848–54, of which 30 occurred in the year 1849 and 17 in 1854. Even the mortality from diarrhœa, exclusive of cholera, was scarcely appreciably raised

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in the year 1849, the deaths having been fewer in that year than in either of the years 1851 and 1852, when there was no epidemic visitation of cholera in this country. Including those from cholera, 4,968 deaths from diarrhœal disease, that is to say, from cholera, diarrhœa, and dysentery, occurred in Birmingham in the eleven years 1848–58. Dividing the eleven years into two periods, each including the year 1854, and consisting the earlier period of seven and the latter of five years, the average annual number of deaths was 477 during the seven years 1848–54, and 447 during the five years 1854–58. The average annual number of deaths in the earlier period is raised by the high mortality of the year 1854. If this year be excluded, the average annual number of deaths during the six years 1848–53, being only 455, is but little in excess of 447, the average annual number of the five years, 1854–8.

Population and rate of diarrhœal mortality.

The population of Birmingham in 1851 consisted of 173,951 persons; if it has increased at an equal rate since that period, as it did between 1841 and 1851, it would consist in 1856 of about 195,000 persons. The year 1851 being the middle year of the septennial term 1848–54, and 1856 being the middle year of the five years 1854–58, the actual population of the former and the estimated population of the latter have been used for calculating the rate of mortality from diarrhœal disease in the two periods. The results of this calculation are, that the annual average number of deaths from diarrhœal disease in Birmingham during the seven years 1848–54 was at the rate of 2·74, and during the five years 1854–58 at the rate of 2·33 per 1,000 persons. These figures indicate a more favourable state of the public health of Birmingham as regards diarrhœa during the last five than during the preceding seven years, an improvement which may perhaps be in some degree attributed to the greater attention which has latterly been paid to local cleanliness by the municipal authorities of the town. Although the epidemic year 1849 was remarkable, as has been already stated, for the very moderate excess of diarrhœal mortality in Birmingham, the epidemic seasons of 1854 and 1857 were characterized by a considerable excess of deaths from this cause over and above the average annual number. This excess is rendered the more evident when the actual number of deaths in each of these years is compared with the number in each of the other years of the period, as shown in the subjoined list:—

Number of deaths in each year.

1848	440
1849	464
1850	444
1851	480
1852	511
1853	392
1854	610
1855	308
1856	358
1857	609
1858	352

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The public health of Birmingham, as indicated by the rate of mortality from all causes during the last five years, has not varied in any essential degree from that of the preceding seven years; the rate, during the seven years 1848–54, having been 27·26, that of the five years 1854–58, 27·50 per 1,000 persons.

Rate of mortality from all causes.

Description of district.

The surface of the soil forming the site of Birmingham is undulating and favourable both to ventilation and cleanliness. The population of the district is entirely urban, and is distributed upon the surface of the soil at the rate of 41,843 persons per square mile. Notwithstanding this, the ground is by no means everywhere closely covered with houses, there being many wide courts and open spaces in the town, and the houses, which rarely contain more inmates than the members of a single family, are seldom overcrowded.

Water supply.

Analysis of public water.

The inhabitants of Birmingham derive their water supply partly from private wells, but chiefly from the public water works, the two modes of supply often intermingling in the same street. The supply from the latter source is constant; samples taken from the principal reservoir on December 21, 1859, were transmitted to Professor Miller for examination, whose analysis is subjoined:—

Analysis of Water taken from the Well-house near the Aston Reservoir, Birmingham.

Hardness before boiling (Clark's scale)	23°·1
Hardness after boiling one hour	14°·7
Specific gravity	1000·62
Solid contents in grains, per imperial gallon:—	
Fixed salts	40·80
Volatile and combustible matter	1·92
Total solid matters	42·72
Nitric acid	1·34
Ammonia	0·04
Cubic inches of gas, per gallon:—	
Carbonic acid	8·33
Oxygen	2·83
Nitrogen	7·86
Total quantity of gases in solution	19·02
Proportion of oxygen to nitrogen	1:2·77

The water is calcareous and hard, contains a good deal of sulphate of lime and sulphate of magnesia, and softens very incompletely on boiling. It also contains a considerable proportion of nitrates, but is tolerably free from organic impurity. The æration is good.

Some of the well water appears to be of good quality, but occasionally water drawn from other wells in the immediate vicinity of the former is unpleasant to the taste, and its freedom from contamination with foreign matters doubtful. Very often,

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where the water supply is obtained from wells, the inhabitants likewise partly use that of the water company, which they steal from the adjoining water-taps or beg from neighbours. Occasionally, where the pump water is of questionable character, and in some instances where a landlord is more than commonly anxious to provide for the comfort and health of his tenantry, the public water has been substituted, the handle of the pump from which the water had been originally obtained being removed or fastened down. Hence it is most difficult to estimate with precision the influence of the water supply in the causation of diarrhœa in Birmingham.

Condition as to drainage, privies,

Birmingham is incompletely drained; privies are in common use, waterclosets being unknown in the houses occupied by the working classes. A single privy sometimes serves for the use of a whole court, and commonly for at least three or four houses. The situation of the privies is often objectionable; sometimes, but not commonly, they are underneath occupied rooms; frequently they are under workshops, and, very often indeed, they are placed either against or so near to houses that the odour arising from them is felt within doors. The cesspools are cleansed, when needful, by the municipal authorities, the landlord being required to give notice at the night-soil office for that purpose. Sometimes the liquid from privies is drained into the sewers, but very often it remains

roadways,

in the mixens until removed by hand. The streets are macadamised, and, for the most part, have been adopted and are repaired by the municipal authorities; they are in general cleanly and

and inspection of nuisances.

in good condition. A systematic inspection of the town for the suppression of nuisances is carried out with tolerable activity by the corporation, and is said by some of the clergy, and by other persons well acquainted with the districts inhabited by the poor, to have been most beneficial.

Division into Heads.

The deaths from diarrhœa in Birmingham during the five years over which the present investigation extends, were unequally distributed as regards—

a, the different years of the period;
b, the different seasons of the year;
c, the several stages of life; and,
d, the different parts of the town.

Fluctuations of mortality from year to year.

a. The fluctuation in the number of diarrhœal deaths, from year to year, has been already shown in a preceding page. It appears from the table (page 41) that the mortality in ordinary years has decreased since 1852, but that it has been much larger in the epidemic years of this period than in any of the previous years. Thus, whilst the deaths from diarrhœal disease in 1849 very slightly exceeded the annual average number, those of the years 1852, 1854, and 1857, very considerably exceeded the average.

Mortality in different months.

b. More than two thirds of the deaths from diarrhœa during the five years 1854-58 occurred in the months of August, September, and October. Supposing the deaths during the five years to have been 1,000, they would have been distributed

among the several months of the year in the manner shown in the following table :— Diarrhœa in Birmingham. Dr. Greenhow's Report.

January	30·4
February	26·1
March	34·3
April	23·2
May	34·7
June	27·0
July	72·0
August	220·0
September	313·0
October	154·0
November	40·3
December	25·0
	1000·0

c. More than half the persons who died during the five years were infants under one year of age; and four fifths of all the diarrhœal deaths occurred to children under five years of age. Calculating the number of deaths from diarrhœa at 1,000, their distribution among the several stages of life is shown in the subjoined table:— mortality. at several periods of life.

Under 1 year	549
From 1 to 5 years	267
From 5 to 60 years	87
Over 60 years	97
All ages	1,000

The proportion of infant deaths varied slightly in the several years of the period. It was smallest in 1854, when only 48·5 per cent. of the deaths were deaths of infants under the age of one year; it was greatest in 1855, when the proportion was 60 per cent.

The proportion of infant deaths varied in the different sub registration districts. Excluding All Saints District, in which the workhouse is situated, by reason of the great number of deaths of persons in advanced life, the largest proportion of infant deaths was in the district of Ladywood, where 64½ per cent. of the diarrhœal deaths during the five years were deaths of children under the age of one year; the smallest was in the district of St. Paul's, where only 46 per cent. of the deaths were deaths of children under one year of age. This discrepancy is doubtless to be attributed partly to the different proportion of infants in the population of the two districts. There is no ready method of computing this difference; but, that it does exist is evident from the fact, that whilst 147 in each 1,000 of the inhabitants of Ladywood were under five years of age when the last census was taken, nly 121 in the 1,000 were under five years of Infants mortality

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age in St. Paul's. That the difference does not arise exclusively from this cause, is also probable, seeing that if the proportion of children has maintained its comparative ratio in the two districts since 1851, the deaths of children under one year of age in Ladywood ought only to be 56 instead of 64 per cent., the proportion in St. Paul's being, as at present, 46 per cent. of the entire diarrhœal mortality.

Local distribution of mortality.

d. The fact already mentioned, that the houses of Birmingham rarely contain more than the members of a single family, enables us to form an approximate estimate of the population of certain districts of the town, and thus to calculate their diarrhœal death-rates. A return, showing the number of dwellings in several streets, has been supplied for this purpose from the Borough Treasurer's office, through the courtesy of Sir John Ratcliff, the late Mayor. A regular census of several streets, the population of which could not have been correctly estimated in the above manner, has also been most obligingly taken by the clergy of the parishes of St. Mary and St. Thomas in aid of this inquiry. From this estimated population of the respective districts, and from the number of deaths in each of these districts, extracted from the death registers for the last five years, their annual average diarrhœal death-rate has been calculated.

In the selection of districts to illustrate the varying rates of diarrhœal mortality in different quarters of Birmingham, such places only have been chosen as are believed to have fluctuated little in population, and in which there has been a continuous mortality during the last five years. The results of calculations based upon such data cannot, it is true, be considered as infallible, but they serve sufficiently well to illustrate the unequal distribution of mortality in separate quarters of the same town. Thus, when we observe in the subjoined table that the annual average proportion of deaths per 1,000 persons in Hospital Street during the five years 1854-8 was nearly eight, whilst it was less than two in New Town Row and St. Vincent Street, we cannot avoid the conclusion that the inhabitants of Hospital Street suffer much more from diarrhœa than those of the other streets, seeing that no conceivable error in estimating the population would account for so vast a difference. The annexed table affords ample illustration of the varying rates of mortality from diarrhœal disease in the several selected districts referred to :—

DIARRHŒA IN BIRMINGHAM.

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Table showing the rate of diarrhœal mortality in certain districts.

Name of District.	Annual Average Number of Deaths from Diarrhœa per 1000 Persons, during the 4 Years 1854-8.
Kennion Street - - -	1·4
St. Vincent Street - -	1·7
Nelson Street West - -	1·9
Great Colmore Street - -	2·2
Bromsgrove Street - -	2·3
St. George Street - - -	2·6
Weaman and Slaney Streets -	2·7
Smith Street - - -	2·8
Thomas Street - - -	3·1
Price Street - - -	3·5
Livery Street - - -	4·2
Hospital Street - - -	7·7
BIRMINGHAM - - - -	2·3

Although the rate of mortality in some of the above districts is twice, thrice, and in one instance even four times as large as in the healthier districts, yet even that of the latter cannot but be considered as excessive, since that of the healthiest district in the table is five times greater than the normal rate of mortality from diarrhœa. While, therefore, on the one hand, we cannot but suppose that some causes of diarrhœal mortality exist in districts like Hospital Street from which healthier streets, such as St. Vincent Street or Newtown Row, are exempt, so on the other hand are we compelled to believe in the existence of causes aggravating the diarrhœal mortality of Birmingham which are comparatively unknown in healthier places. To ascertain, if possible, the nature of these causes, the several selected districts were visited, and the sanitary circumstances of the population carefully inquired into.

Kenyon Street.

Kenyon Street is a short street bent upon itself at right angles, so as to interfere materially with its ventilation. It is generally speaking in a good condition, and has courts communicating with it on either side, some of which are open and airy, others confined and close. The privies to court No. 8, which is one of the closer courts, are situated beneath inhabited rooms, but no reliable information respecting the health of their inmates could be obtained. The inhabitants are, for the most part, working people, and the street is chiefly remarkable as an example of a close, ill-ventilated street, in which the diarrhœal mortality has been small. The water supply is partly from wells on the premises, partly from the public waterworks.

St. Vincent Street District.

St. Vincent Street District comprises St. Vincent Street, Ledsam Street, Sherbourn Street, and Cottage Lane, of which Ledsam Street is entirely, and Sherbourn Street and Cottage Lane partially, sewered. These streets are airy and tolerably

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well conditioned; there is much open ground in the neighbourhood, and many vacant sites for houses still remain in the streets themselves. The courts are usually in good order, generally spacious, and sometimes contain plots of garden ground. There are also in these streets many houses of a superior class, such as are occupied by persons considerably above the condition of artisans, and the inhabitants generally are by no means of the poorer sort. The courts are paved with vitreous bricks, and the privies are mostly at a sufficient distance from the houses to cause no annoyance. The water supply is derived partly from private wells, partly from the public waterworks, sometimes from both. The houses in courts are often built back to back, so as to prevent thorough ventilation, a mode of building very common in Birmingham. The privies were sometimes in an offensive state from neglect of cleansing; and in one or two places they are so situated as to infect the atmosphere of houses with their exhalations. In a court of this kind, at the back of No. 175, St. Vincent Street, but which also communicates with Ledsam Street, there had been much diarrhœa; and at least one recent case was so severe that the patient only recovered on removal to a purer atmosphere. In a court behind No. 28, Cottage Lane, which was in a filthy state when visited, and was said to be habitually so, both fever and diarrhœa were reported to have been prevalent. In another court in the same street, which, although open in the middle, was surrounded on all sides by houses, and in which there were dwellings over a huge privy, diarrhœa had been more or less prevalent in most of the houses, and cases existed in the house over the privy at the time of inquiry. Mr. Richards, one of the Union medical officers, said he always had cases of diarrhœa in this court. There are other streets of a like character in the same neighbourhood, in some of which analogous facts were elicited on inquiry.

Local conditions producing diarrhœa.

Nelson Street.

Nelson Street intersects Ledsam Street and Cottage Lane; it is generally speaking in good condition. Some of the courts, such as Trafalgar Place and Nile Place, have garden ground in front of the houses; and, excepting that in one or two instances, the privies are underneath dwellings, as in the court behind No. 123 and in Allen's Place; the street is in good order. The water is almost, if not quite exclusively, obtained from the public waterworks.

Great Colmore Street District.

Great Colmore Street District includes Latimer Street South, Irving Street, Bow Street, Little Bow Street, Windmill Street, Windmill Hill, and Cregoe Street. Most of these streets are wide and airy and in good order. The courts are cleanly and well kept, and the inhabitants of a mixed character, but without any of the very poor. The population of this group of streets exceeds seven thousand, and the diarrhœal death-rate scarcely differs appreciably from that of Birmingham. The water supply is chiefly from the public waterworks.

Bromsgrove Street District.

This group of streets, together with the *Bromsgrove Street* group, which includes Sherlock Street, Lower Hurst Street, Barford Street, Barford Street South, Lower Essex Street, Gooch Street, and Kent Street, and contains a population of

nearly 9,000 persons, are good examples of the better-conditioned parts of Birmingham. The two groups are very similar in condition, and correspond very nearly in their rate of diarrhœal mortality. The streets of neither group are entirely sewered, but a larger proportion of those classed with Bromsgrove Street have sewers than of those comprised in the group with Great Colmore Street.

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St. George Street, in a different quarter of Birmingham, is another example of a well-conditioned street, the diarrhœal mortality of which is not much greater than that of the whole of Birmingham. No unequivocal cause could be discovered why the mortality of this street exceeds that of those already described. The courts are usually spacious and free from any obvious nuisance, excepting that the privies, although at a sufficient diswnce from the houses, were sometimes in a foul condition. The taater supply is obtained almost exclusively from the public waterworks.

St. George Street.

Weaman and Slaney Streets are not sewered, and are inhabited by a very poor class of persons. They are parallel with each other, and communicate one with the other by numerous narrow courts; they have also courts on both sides. These courts are often narrow, sometimes very close, and the ground is much more densely covered with houses than in any of the streets hitherto described. The water supply is almost exclusively procured from the public waterworks. There are privies for every three or four houses, which are sometimes in an offensive condition, but in only one place, court No. 21, Weaman Street, was a privy observed to be immediately underneath an occupied room. The effect of confining the exhalations from privies in a narrow space, so as to prevent their rapid dispersion into the atmosphere, appeared to be shown in court, No. 5, Slaney Street. A high wall, which materially affects the ventilation of the court, having recently been erected, the inhabitants are said to have been much less healthy since, and diarrhœa in particular to have been very prevalent. The history attached to a house in court No. 17, Weaman Street, seems to afford satisfactory proof of the influence of a foul atmosphere in producing diarrhœa. The cellar underneath this house contained, when visited, and had contained for eighteen months, a quantity of very offensive water, which was alleged to percolate the wall from an undrained cesspool in the adjoining yard. The inhabitants of the house over the cellar have all had diarrhœa, some of them almost constantly, since the water has been there. The inhabitants of the next house, and other residents of the yard have, during the same period, continued perfectly well. A somewhat similar history attaches to court No. 9, Weaman Street. The court was in good order when visited, and is said to have always been kept in a cleanly condition, but the privies are directly opposite and not very far from the houses, and were on a certain occasion, several years ago, in a very foul and offensive state. It was asserted by an inhabitant of the court of eighteen years standing, an assertion confirmed

Weaman and Slaney Streets.

Local conditions produducing diarrhœa.

and fever.

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by the scripture reader of the district, that a severe outbreak of fever and diarrhœa took place in the court at the time when the privies were the most offensive. The fever appears evidently to have been of the form called typhoid, the description given of its symptoms being very straightforward and exact. Further illustrations of a similar kind were afforded by courts Nos. 8 and 21 Weaman Street. No. 21 is a clean, well-paved court, but ill-ventilated, and the privy is underneath a room. Diarrhœa prevailed among the inhabitants at the time of visit, but it was not ascertained whether the inmates of the house over the privy had suffered more from this disease than other residents of the court. The privy in court No. 8, which is likewise a close court, directly faces a house door. The person who resides in the house stated that all the members of her own family and those of her next door neighbour had suffered from diarrhœa, both in the summer of 1857 and in that of 1858. On a house to house inquiry it was found that diarrhœa had not occurred in any other house in the court during either of those years.

Smith Street District.

Smith Street District is on the outskirts of the borough bordering on the parish of Handsworth, and includes Smith Street, Farm Street, Tower Street, Lower and Upper Tower Streets, Unett Street, Brearley Street, Brearley Street West, Bridge Street West, and New John Street West. This group of streets contains a population of nearly 12,000 persons, which has undergone an average annual mortality from diarrhœa at the rate of 2·8 in each 1,000 persons. But the deaths have been unequally distributed in this district, for whilst the average annual mortality from diarrhœa in Bridge Street West and New John Street West has been at the rate of less than 2 in the 1,000, it has been at the rate of 3 in the 1,000 in the Tower Streets, and between 4 and 5 in the 1,000 in Farm Street.

Bridge Street West.

Bridge Street West, which is remarkable for its low rate of mortality, is open and incomplete, but was said to have been stationary as regards population; it is not sewered, and has not yet been adopted by the municipal authorities. The courts and yards are generally clean, well ventilated, and free from obvious nuisances, or any discoverable cause of atmospheric contamination. The water supply is chiefly from wells, more rarely from the public water works.

Tower Street.

Tower Street, Lower and Upper Tower Streets, form a continuous line, are broad and airy, but ill kept; they are not drained, and the street channeling is defective. One portion is so flat that water stagnates on the surface, the remainder has a good descent. The population of the front houses consists of a class of persons considerably above the poorer sort. Some of the courts are close, others are airy. The privies were often in a foul condition, but in no instance underneath houses, although they are very often beneath workshops, and sometimes placed against houses. There are in these streets a few cellar dwellings, which is rare in Birmingham. The water supply is derived partly from the public waterworks, partly from private wells.

The Tower Streets occupy an intermediate position as regards cleanliness, ventilation, and the condition of the courts and houses between the healthier groups of streets previously described and Hospital Street. The estimated population is nearly 3,000, a number sufficiently large to afford great probability to the correctness of the death-rate, and the number of deaths from year to year has been remarkably steady.

Farm Street.

Farm Street, the average annual mortality of which from diarrhœa has been at the rate of 4·4 per 1,000 persons during the last five years, like some other streets in this outlying portion of the borough, is incomplete and airy; it is sewered, but in its rear, at a short distance from the houses, is a foul ditch of stinking water, which forms the boundary between Birmingham and Handsworth. The street is ill kept, the channels being foul, and here and thete up and down the street were little heaps of refuse. The course are usually spacious, and sometimes have garden ground attached, but are by no means well kept, being often in a filthy state; pigs were observed in many of them: and although the privies are not under houses, they are frequently beneath workshops, and the source of offensive exhalations. Sometimes these conveniences are sufficiently distant from the dwellings, but more frequently they are very near to, or even built against, them The water supply is almost entirely from private wells.

Thomas Street. Districts.

Thomas Street, with John and London Prentice Streets, forms the next group. These are narrow streets, inhabited by labouring people; some of the courts are very narrow and confined, and in three or four of them the privies either are or were, until recently, underneath inhabited rooms. Sometimes these conveniences are placed against the walls of houses which, as they are not drained, is very likely to lead to the percolation of liquids into the houses. The privies were very frequently indeed the source of offensive effluvia.

Price Street District.

Price Street District includes Lench Street, Loveday Street, and Lancaster Street. Loveday Street is the most open, being divided in the middle by St. Mary's Square; it has a much smaller mortality from diarrhœa than the other streets of the group; their respective death-rates from diarrhœa during the five years being—Loveday Street, 2·2; Price Street, 3·3; Lench Street, 3·4 and, Lancaster Street, 4·6 per 1,000 persons. The population was taken by a census from door to door, and as it is believed not to have fluctuated materially during the last five years, the above quoted death-rates are, in all probability, nearly correct. It is remarkable that Lancaster Street, which is broad and airy and sewered, should exhibit a higher rate of mortality than Price and Lench Streets, which are not drained, are much narrower, and more confined. The only apparent causes of the difference were, that pigs are kept in several of the courts in Lancaster Street,—and it is almost impossible to keep pigs in the midst of a town without causing a nuisance—and that the privies are more frequently placed in such a position that their exhalations penetrate into the houses. Although court No. 21 Lancaster Street is drained, it is close

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and offensive, probably because the liquid of the privies is carried away in the drains, which are not properly trapped. Diarrhœa has not prevailed in the court, but there has been typhoid fever, which commenced in a house directly opposite an untrapped and very offensive sink. In court No. 27 there are privies below workshops, and also underneath an occupied room. Diarrhœa has prevailed almost constantly in the court, and, it was said, especially in the house adjoining and partly over the privy. In like manner diarrhœa has prevailed in court No. 24, the privies of which are built against the wall of a house, and were in bad order. The courts in Price Street are generally spacious, well ventilated, and comparatively free from the defects just mentioned as existing in the courts of Lancaster Street. In other respects the houses in all these streets are very much alike, are seldom overcrowded, and rarely have thorough ventilation, being often built back to back. The water supply is of the usual mixed character, being obtained sometimes from the public waterworks, sometimes from private wells.

Livery Street District.

Livery Street District includes Livery Street, Henrietta Street, Water Street, Mary-Ann Street, Bread Street, and Little Charles Street. Livery Street is partially drained; it is open and airy, the greater portion of one side being occupied by the Great Western Railway Station; its inhabitants are chiefly of the lowest and poorest class, and the courts are often foul. In one court was a privy underneath an occupied room; in several others the privies were very near to the houses; sometimes these conveniences were underneath workshops, and they were frequently overcharged and gave off exhalations immediately perceptible on entering the courts. Pigs were found in some of the courts. The water supply is sometimes obtained from taps in the courts connected with the mains of the water company, but more generally from private wells. Mary-Ann and Henrietta Streets form a continuous line of street, which is intersected by Livery Street. The ventilation of Henrietta Street is interfered with by the Great Western Railway, which crosses it near its termination at Livery Street. Both streets are peopled by the poorer class, but those in Henrietta Street are probably the poorest. The courts of Mary-Ann Street are for the most part open and airy; those of Henrietta Street are sometimes spacious and airy, but they are generally foul, and the privies in most of them are underneath inhabited rooms. The population of these streets is small, that of Henrietta Street being estimated at a little over 400 persons, and that of Mary-Ann Street at a little under 300. The rate of mortality from diarrhœa, which is about 7·2 per 1000 persons annually in Henrietta Street, and 4·3 in Mary-Ann Street, cannot therefore be considered as quite trustworthy. Yet it is worthy of note that the higher rate of mortality has prevailed in the street which is the worst ventilated, and the inhabitants of which breathe an atmosphere tainted with the products of fæcal decomposition.

Hospital Street

Hospital Street as it presents a much higher rate of mortality

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from diarrhœa than any other street of the same size in the borough, so likewise does it possess, in an aggravated degree, the evils which have been so inseparably connected with an excessive diarrhœal mortality in other parts of Birmingham. It is closely built, old, only twenty yards wide, and the houses are almost, if not quite, all three stories high. There is an old sewer in the street, too shallow to drain the privies, the liquid contents of which accumulating add to the nuisance caused, under the most favourable circumstances, by the existence of mixens and cesspools in the immediate neighbourhood of dwellings. There are courts on both sides of Hospital Street, the aggregate population of which considerably exceeds that of the main street. A few of the courts are well ventilated and in good sanitary condition, but the majority are close, ill-ventilated, and bad in condition; the existence of privies underneath or in such close contiguity to houses that their exhalations sensibly contaminated the atmosphere within doors, which was the exception in some of the other streets of Birmingham, is here very common. On the one hand, the coincidence of this arrangement with the prevalence of diarrhœa was distinctly traced in several of the courts, and, on the other, the comparative exemption from diarrhœa of better arranged courts was also clearly ascertained. The water supply is chiefly from the public waterworks, but also partly from wells situated in the courts.

Local conditions producing diarrhœa.

There is in Hospital Street a range of almshouses belonging to Lench's trustees, forming a square court, which, as might be expected in such an establishment, is cleanly, spacious, and in good order. The inmates, who must have attained the age of 60 years previous to admission, are very subject to diarrhœa, which the matron asserts has been sometimes more prevalent when the privies have been so foul that the odour from them pervaded the court. The drainage is imperfect, the sewer in the street being too shallow to carry away the refuse water from the ashpits. Notwithstanding the alleged coincidence between the prevalence of diarrhœa and the foul state of the privies, it is by no means clear that the two circumstances stand in this instance in the relation of cause and effect, seeing that diarrhœa prevailed throughout the establishment at the time of inspection, and some of the houses are too distant from the privies to be affected by any emanations that might arise from their contents.

Summary.

Local conditions associated with diarrhœa.

The preceding facts appear to denote an intimate connection between excessive diarrhœal mortality and certain local peculiarities. Visiting cleanly districts but slightly, diarrhœa has exhibited in Birmingham a manifest tendency to prevail in places where human excrement is allowed to accumulate in cesspools or privies. The facts of the case are so striking, on the one hand the prevalence of diarrhœa in districts where this impurity exists; and, on the other, the comparative immunity from mortality of other districts resembling the former in all respects save the absence of this impurity, have been so constant, that it is impossible not to admit the relationship as one of cause and effect. But the cause

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is not an exclusive one, seeing that fatal diarrhœa has not been entirely unknown even in the best and cleanliest parts of the borough. The presence of fæcal impurity infecting the atmosphere must, therefore, be classed only as a principal cause of diarrhœa, and the existence of other causes must be conceded.

Instances were adduced in which the use of well water, contaminated by the percolation from sewers or cesspools, had caused diarrhœa, and, in some cases, fatal diarrhœa. Some of the evidence on this head was unquestionable, being afforded by persons accustomed to scientific observation, who had verified the fact by an examination of the suspected wells; but the cases thus circumstantially detailed were referable to a period anterior to that of the present investigation, and, although there was reason to suspect the existing well water of being occasionally sullied with decomposing organic matter, no certain instance was elicited in the course of the inquiry.

Alleged causes of diarrhœa.

The medical practitioners of Birmingham attributed the prevalence of diarrhœa, which they admitted to be a very common disease in that town, to the mismanagement of young children, especially in respect of feeding; to the neglect of infants, particularly if illegitimate, by their mothers, when employed in factory labour; and, to the use, by older persons, of decayed fish or other unwholesome food, which was alleged to be sold in large quantities during the autumn months. Much stress was laid upon these facts by some of the Union medical officers, but all were unanimous in expressing their belief that defective drainage and the presence of nuisances—such as overcharged cesspools, foul privies, and pigsties—tainting the atmosphere with the products of organic impurity, are intimately concerned in the causation of diarrhœa. Guided by personal experience, it was some of these gentlemen who suggested inquiry in several of the above-mentioned places, and the result of the investigation fully justified their opinion. Not only has diarrhœa prevailed and proved most fatal in streets where such causes of atmospheric impurity existed, but, as has been abundantly shown in the history of particular streets and courts, it has also selected as its victims persons much exposed to these causes, to the comparative exclusion of others. There can, in fact, be no doubt that the privy-nuisance of Birmingham is largely accountable for the high diarrhœal mortality of that town.

Additional corroboration of this view may be gathered from the fluctuations of mortality from year to year. Save that the mortality of 1852 was excessive, the number of deaths in each of the five years 1848-52 was very steady and did not materially fluctuate. An Improvement Act was obtained in the latter of these years, and measures were energetically adopted for the sanitary improvement of the borough. These measures have not effectually dealt with the privy nuisance, and have also, in other respects, been imperfect, but they have mitigated the evil and caused the removal of the more obvious nuisances. This activity has been coincident with a diminution of diarrhœal mortality in ordinary years, the number of deaths in the years 1853,

1855, 1856, and 1858, notwithstanding the augmented population, having been fewer than in any of the five years 1848-52. The years 1854 and 1857, when the mortality was considerable, were periods of epidemic visitation. That the diarrhœal mortality of Birmingham continues so large is no doubt due to the circumstance that the exertions of the local authorities have been directed rather to the removal of local uncleanliness than to the promotion of local cleanliness; rather to draining foul privies and emptying cesspools than to preventing the storage of fæcal matter in the heart of the town. So long as privies exist underneath houses and cesspools in the immediate vicinage of human dwellings so long will the most vigilant cleansing fail to suppress the most unquestionable and influential cause of diarrhœa in Birmingham.

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Wolverhampton.

Wolverhampton.

Cholera occasioned 1,364 deaths in the Registration district of Wolverhampton in 1849. It fell very lightly on the same district in 1854, only 40 deaths from cholera being entered in the local death registers of that year. Exclusive of deaths from cholera in 1849, but including the 40 deaths in 1854, diarrhœal disease, that is to say, diarrhœa, dysentery, and cholera, has destroyed 2,299 lives in Wolverhampton during the 11 years 1848-58, of which 1,531 occurred during the seven years 1848-54, and 1,140 during the five years 1854-58. The average annual number of deaths during the earlier period of seven years was 219, or if the year 1854, when diarrhœa and cholera were epidemic, be excluded, the average annual number of deaths during the six years 1848-53 was 193; the annual average during the five years 1854-58 has been 228. As the deaths during the latter period occurred among a larger population, the above figures fail to give an accurate view of the present as compared with the former diarrhœal mortality of Wolverhampton. The population of Wolverhampton consisted of 104,158 persons in 1851. If it has gone on increasing in the same ratio since 1851, as it did during the 10 years that elapsed between the years 1841 and 1851, it would amount to upwards of 110,000 persons in 1856. If, therefore, these figures, the actual population of 1851, and the estimated population of 1856, be employed for calculating the death-rates, the average annual proportion of deaths from diarrhœal disease in Wolverhampton was 2·10 per 1,000 persons during the seven years 1848-54, and 1·93 during the five years 1854-58. A lower rate of mortality, generally, has also existed in Wolverhampton during the later as compared with the earlier period; the death-rate from all causes, which was 3·024 per 1,000 persons during the seven years 1848-54, having been only 28·27 during the five years, 1854-58.

Diarrhœal mortality.

Population and rate of diarrhœal mortality.

Rate of general mortality.

The Registration district of Wolverhampton consists of the Wolverhampton and Seisdon Unions, the former of which includes the towns of Wolverhampton, Bilston, and Willenhall, besides Wednesfield and other semi-urban places; the latter is

Description of Registration District.

Diarrhœa in Wolverhampton.

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a rural district. The rate of mortality, both from all causes and from diarrhœal disease, varies much in these several districts. The population of each place for the year 1856 having been estimated on the assumption that the rate of increase has been the same since taking the census of 1851, as it was during the previous ten years, the average annual death-rates for the five years 1854–58 from all causes and from diarrhœa have been calculated, and are shown in the following table:—

Table showing the rate of mortality in sub-districts.

Name of District.	Number of Deaths per 1,000 Persons during the Five Years, 1854-8.	
	All Causes.	Diarrhœa.
Seisdon (Union) - - -	17·63	0·73
Wolverhampton (Sub-District) - -	28·72	2·44
Bilston - - - -	29·24	1·81
Wednesfield - - - -	30·40	1·52
Willenhall - - -	31·30	1·79
Wolverhampton (Registration District)	28·27	1·93

From this table it appears that, although the death-rate from all causes in Wolverhampton Proper has been smaller than in Bilston, Willenhall, or Wednesfield, yet the rate of diarrhœal mortality has been very considerably higher in the former than in any of the three latter districts.

Division into heads.

The deaths from diarrhœal disease in Wolverhampton during the five years 1854–8 have been unequally distributed, as regards—

a, The different years of the period;
b, The different seasons of the year;
c, The several stages of life; and,
d, The different parts of the district.

Mortality in different years.

a. The number of deaths in each of the 11 years is shown below. It appears from the list that epidemic outbreaks of diarrhœa occurred in the years 1852, 1854, and 1857.

1848 - - -	122
1849* - -	251
1850 - - -	130
1851 - - -	190
1852 - - -	272
1853 - - -	194
1854† - - -	372
1855 - - -	133
1856 - - -	199
1857 - - -	285
1858 - - -	151

* Exclusive of 1,364 deaths from cholera.
† Including 40 deaths from cholera.

b. Nearly two thirds of the deaths during the five years occurred in the months of August, September, and October. If the deaths from diarrhœal disease in Wolverhampton during the five years had been 1,000, they would have been distributed among the several months of the year in the following proportions :—

Mortality in different months.

January	36·8
February	31·8
March	28·5
April	26·8
May	34 5
June	38·5
July	53·6
August	177·7
September	304·3
October	168·5
November	65·5
December	33·5
	1000·0

Mortality at several periods of life.

c. Rather more than half the diarrhœal deaths in Wolverhampton during the five years were deaths of infants under the age of one year, and upwards of four fifths those of children under five years of age. If the deaths during the five years had been 1,000, their distribution among the several stages of life would have been as follows:—

Under 1 year	522·2
From 1 to 5 years	310·1
From 5 to 60 years	94·0
Over 60 years	73·7
	1000·0

The proportion of infant deaths varied from year to year; the epidemic of 1854 would appear to have fallen more heavily on older persons, seeing that the deaths of children under one year of age from diarrhœal disease in that year did not amount to half the mortality. Infant deaths formed 45·8 per cent. of the diarrhœal mortality in 1854; 57·8 per cent. in 1855; 53·0 per cent. in 1856; 55.9 per cent. in 1857; and 52·8 per cent. in 1858.

Infant mortality.

The proportion of children's deaths varied materially in the several sub-districts. Whilst more than four fifths of the deaths from diarrhœa in the township of Wolverhampton were deaths of children who had not attained the age of five years, considerably less than three fifths of the deaths from diarrhœa in the Seisdon Union belonged to that early stage of life. Less than one sixteenth of the diarrhœal deaths of the township of Wolverhampton were deaths of persons over 60 years of age; more than one fourth

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of all the diarrhœal deaths in Seisdon were those of persons of advanced life. The exact proportion referable to each stage of life for the several districts is shown in the subjoined table, in which it has been assumed that 1,000 deaths have occurred in each place,—

Table showing the mortality at several periods of life in the sub-districts.

——	Under one year.	From one to five years.	From five to sixty years.	Over sixty years.	All Ages.
Seisdon (Union) -	431·3	98·2	196·0	274·5	1,000
Wolverhampton Sub-District.	579·0	269·7	91·3	60·0	1,000
Bilston - -	402·6	432·9	82·2	82·3	1,000
Willenhall and Wednesfield.	468·9	378·5	90·4	62·2	1,000

Local distribution of mortality.

d. The mortality from diarrhœa has been unequally distributed among the several parts of Wolverhampton. This has already been shown for the several registration sub-districts in the table on page 51; the diarrhœal death-rate of the almost exclusively urban township of Wolverhampton, being threefold that of the Seisdon Union, and very considerably higher than those of Bilston, Willenhall, and Wednesfield. The public health of Seisdon being so satisfactory, it was not deemed necessary to prosecute inquiries into its local condition, and the rate of mortality has been calculated solely with a view to its comparison with the other portions of the Wolverhampton Registration district. The local distribution of diarrhœal disease and the sanitary condition of Wolverhampton Township, Bilston, and Willenhall were minutely investigated. With each of these places it will be desirable to deal separately.

WOLVERHAMPTON TOWNSHIP.

Population and description.

WOLVERHAMPTON TOWNSHIP includes the town of Wolverhampton the site of which is not by any means densely covered with houses. It contained 49,925 persons in 1851, and probably about 60,000 in 1856. It is insufficiently drained; a new drainage scheme being at present under consideration. Privies are the kind of convenience ordinarily attached to the dwellings of the poorer classes; one of these conveniences usually serving for several houses. As in other places, they are often very noisome to the inhabitants of imperfectly ventilated courts and streets, and are too frequently placed almost in juxtaposition with dwellings. The cesspools are emptied by the municipal authorities on application being made for that purpose. The water supply of Wolverhampton is chiefly procured from the public waterworks. The following is the result of Professor Miller's analysis of samples taken from the service reservoir at Goldthorn Hill, on December 21, 1859:—

Analysis of public water.

ANALYSIS of Water taken from the Reservoir at Goldthorn Hill, Wolverhampton.

Hardness before boiling (Clark's scale) - -	17°·6
Hardness after boiling one hour - -	5°·8
Specific gravity - - -	1000·53
Solid contents, in grains, per imperial gallon :—	
Fixed salts - - - -	20·24
Volatile and combustible matters -	1·76
Total solid matters - -	·0
Nitric acid - - - -	0·41
Ammonia - - - -	0·03
Cubic inches of gas, per gallon :—	
Carbonic acid - - - -	9·17
Oxygen - - - -	1·99
Nitrogen - - - -	6·24
Total quantity of gases in solution -	17·40
Proportion of oxygen to nitrogen - -	1 : 3·1

The water is calcareous and hard, is tolerably free from organic impurity, contains a little sulphate of magnesia, but softens considerably by boiling. It is fairly aerated, and may be considered as a good water for a town supply.

Rate of diarrhœal mortality.

The mortality from diarrhœa in the township of Wolverhampton during the five years, 1854-58, was at the rate of 2·44 per 1,000 persons, being greater in proportion to the number of inhabitants than in any other portion of the Wolverhampton Registration district. But this mortality has not been equally large in every part of the town, for in some quarters it has been very much below, in others far above, the general average. Some illustrations of this fact are shown in the subjoined table, which gives the annual average diarrhœal death-rate per 1,000 persons, during the five years 1854-8, in certain parts of the town selected for this purpose, because they have been ascertained to afford the most trustworthy data for such a comparison :—

Table showing the rate of diarrhœal mortality in certain districts.

Name of District.	Death-Rate per 1,000 persons.
Springfields - - -	1·7
Falkland Street - -	1·9
Little Brickiln Street - -	2·1
Salop Street - - -	2·2
Stafford Street - -	2·3
Canal Street - - -	2·6
St. Matthew Street - -	3·3
Blakenall - - -	3·5
Duke Street - - -	3·7
Mormon Green - -	4·2
WOLVERHAMPTON (Township) -	2·44

Diarrhœa in Wolverhampton.

Dr. Greenhow's Report.

Springfield.

Springfield is a cluster of streets adjoining the town, surrounded on three sides by open fields, and bounded on the fourth side by the Great Western Railway. The situation is so airy that it can scarcely be considered as a portion of the town; the streets and houses are in good order, and amply supplied with water and other conveniences. The population is of the labouring class, but contains many mechanics and other persons in the receipt of good wages.

Falkland Street District.

Falkland Street district, comprising Falkland Street, Herbert Street, Southampton Street, and Little's Lane, is a group of streets adjoining the railway, by no means densely built, and being open at the end nearest the railway, freely ventilated; the contour of the surface is favourable to the discharge of fluids, and the streets are in good condition. The water supply is procured partly from private wells, some of which are described as affording water of good quality, partly from the public waterworks. Some of the houses are built back to back; the front houses having entrances from the streets, the back ones from the courts. In some places the houses of parallel courts are back to back with each other. There are several courts, some of which communicate at either end with parallel streets. The majority of these courts are in good condition as regards cleanliness, which may be said to be the prevailing character of the district; but some of them were not paved, and several are narrow and imperfectly ventilated; pigs were observed in a few places; and one or two of the courts, inhabited by the lower order of Irish, were exceedingly dirty. The privies are usually at a safe distance from the dwellings, and, with few exceptions, as in Southampton Street, where some of them are within a few feet of the back doors of houses, and in one of the courts of Little's Lane, where the privy is beneath an inhabited room, the inhabitants of the district are but little exposed to fœcal exhalations.

Little Brick-kiln Street District.

Little Brick-kiln Street district includes Little Brick-kiln Street, Compton Street, Hallet's Row, and Graisley Row. These are narrow streets and lanes, through some of which there is no thoroughfare for vehicles. They are not in very good condition, and there is a very foul ditch at no great distance from some of the houses. The water supply is chiefly obtained from private wells. Some of the courts and yards were well paved and clean; others not yet paved were in bad condition. Although the streets themselves are narrow the neighbourhood is open, and there are gardens to some of the houses. The privies are generally well apart from dwellings, but in some instances workshops have been constructed above them, so as to interfere materially with ventilation. Pigs are kept in several places, but usually at a distance from the houses; the rule in Wolverhampton being not to prohibit entirely the keeping of pigs, but to enforce their removal when the styes are so near to dwellings as to be a nuisance to the inhabitants or to be considered dangerous to health. From the evidence of the inhabitants diarrhœa does not appear to have been unusually prevalent at any recent period in

this district, neither was it specified by the medical men as being, in respect of the prevalence of diarrhœa, an unhealthy place. DIARRHŒA IN WOLVERHAMPTON.

Salop Street district includes also Brook Street and Bennett's Fold. Salop Street contains many houses of a superior class, is airy, and a considerable portion of it has open country in the rear. There are courts behind this street, some of which were very clean, airy, and in good condition; others are more confined, and were less cleanly or contained dangerous nuisances. For instance, the privies in court No. 2, where diarrhœa has existed, are near to the houses at the upper end of the court, and were complained of by the inhabitants as being most offensive. The privies of court No. 3 leaked into the court, and diarrhœa had occurred during the past summer in both the houses affected by the stench. The privies are situated between two houses in court No. 8, and are placed against a house in court No. 2, an arrangement which, although no evidence of injury to health was elicited from the inhabitants, experience in other places has abundantly proved to be dangerous. The water supply is obtained partly from private wells, partly from the public waterworks There was reason to suspect that some of the well water was contaminated, but in no instance was evidence procurable which could associate the existence of diarrhœa in this district with the ingestion of impure water. Dr. Greenhow's Report. Salop Street District.

Stafford Street is very similar to some of the places already described; a portion of it is very airy, and some of the courts were in good condition, others in a filthy state, although active efforts have been made by the municipal authorities to improve their sanitary condition. Both pump and tap water are in use in the street, but the latter is said to have been only introduced within the last two years. The houses in some of the courts are built back to back. Some of the worst parts of Wolverhampton are in the rear of this street, and have been excluded from the district now under consideration, on account of the inhabitants belonging to a very different class, and being of too migratory a character to afford reliable data for statistical inquiry. Considered apart from the Irish quarter in its rear, Stafford Street, presents the mixed character which might be expected from its position with reference to diarrhœal mortality. Portions of it are in an unexceptionable condition, others exhibit the kind of local nuisances with which the prevalence of diarrhœa has already been shown to be associated. Stafford Street.

Carbery, or, as it is some times called Caribbee Island, Back Lane, and Castle Place are ill-conditioned courts in the rear of Stafford Street. Cholera prevailed in them in 1849, and the medical men reported fever and diarrhœa as being sometimes very prevalent among the inhabitants. They have been recently channelled and supplied with water; privies have been constructed; and the courts are now regularly cleansed by the public scavengers. Although said to be much improved, they are still in bad condition. The rate of diarrhœal mortality in these courts could not be estimated, neither could any trustworthy information on the subject of its prevalence be obtained from the inhabitants,

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who almost entirely belong to the lowest class of Irish, and frequently change their residence.

Dr. Greenhow's Report.

Canal Street.

Canal Street is narrow, but clean and well kept, and intersects Stafford Street near its junction with Berry Street. It possesses a good natural descent, affording facilities for the discharge of surface drainage. On either side of the street are courts which are among the closest in Wolverhampton. Some of these courts were almost as bad as Caribbee Island, and the ventilation in several of them is so imperfect that although the privies do not immediately adjoin the houses their effluvia must pervade the courts in hot still weather. There were many cases of cholera in these courts in 1849.

St. Matthew Street District.

St. Matthew Street, together with Moor Street, Hill Street, and Cross Street, forms a well-defined district on the outskirts of the town, by the side of the Walsall Road, near to the Chillington ironworks. The situation is very smoky, but otherwise open and airy. The streets are dirty and ill kept, water remaining stagnant in the channels. The privies are sometimes placed in objectionable situations, and in one or two places beneath inhabited rooms. There are in the neighbourhood several foul ditches and some waste ground in a very filthy condition; and many pigs are kept, sometimes in yards behind the houses, sometimes on open ground sufficiently distant to render them unobjectionable. The water supply is obtained partly from the public waterworks, partly from wells on the premises. The inhabitants are for the most part miners or persons employed in the adjacent iron works.

Blakenall.

Blakenall is a hamlet, formerly about a mile from Wolverhampton, but now on the borders of the town; it stands on an eminence, and is all but surrounded by unoccupied land. The roads are ill-kept, and until recently all the liquid refuse passed into an open ditch, which was in a very foul state, but has lately been arched over. The water supply is procured from pumps. There was nothing sufficiently definite at the time of inspection to account for the high diarrhœal mortality, but the condition of the place is said to have been much ameliorated.

Duke Street District.

Duke Street district, in addition to the street from which it is named, comprises Oxford, Cross, Bath, York, East, Wharf, Little Moor, Warwick, Brunswick, and Park Streets, which form a well-defined quadrangular block of streets. These streets are inhabited exclusively by the working classes, and chiefly, it was said, by persons employed in the neighbouring iron factories. The water supply is derived partly from the public waterworks, but also partly from wells. The well in court No. 5, Warwick Street, is situated at not more than nine feet from a cesspool. Diarrhœa had recently prevailed in nearly every house in the court, attacking adults as well as children. The court was clean, but the privies were in an offensive condition. A foul ditch runs parallel to Oxford Street and very near to some of the houses. Some of the courts in these streets were in good condition, others very much the reverse, and many removable nuisances existed in them at

the period of inspection. The effluvia from the privies pervaded many of the courts and yards. In several of the courts the privies are underneath inhabited rooms; and pigs, which until recently were kept in great numbers in this neighbourhood, have by no means entirely disappeared.

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Monmore Green is a well-defined district, bordering on the town of Wolverhampton, and on one side of the Bilston Road. It consists of a cluster of unpaved, undrained, and ill-regulated streets, with channels in which water stagnates, and is surrounded by foul open ditches which receive the surface drainage. Cholera was exceedingly fatal here in 1849. There are several filthy courts, and the privy nuisance, so common throughout Wolverhampton, is found here in an aggravated degree. The inhabitants are principally miners.

Monmore Green.

Other parts of Wolverhampton, the diarrhœal death-rates of which could not be calculated in a reliable manner, are similar in character to those already described. Sometimes the purity of well water was questionable, as in Pountney's Fold, where the water from a pump which supplies 47 houses was opaque. Diarrhœa has prevailed among the inhabitants, but it is said not to any great extent; with the single exception of 1856 it has caused an annual mortality, small indeed in actual amount, but probably large in proportion to the population. Cholera was so prevalent in this court in 1849, that it was found expedient to remove most of the inhabitants. Great improvements are said to have been effected since that time.

Other parts of Wolverhampton.

Complaints of the well water were not uncommon in Wolverhampton, but the occurrence of diarrhœa in connection with the supposed unwholesome water was in no case clearly established. The privies are a principal nuisance in every quarter of Wolverhampton, even where placed in the least objectionable situations. They were frequently reported to be offensive in warm weather, a fact by no means suprising, since in the streets and courts inhabited by the poorer classes, one privy commonly serves for several houses, and several privies are sometimes placed side by side, so that the nuisance is concentrated. But privies were also often placed in very dangerous proximity to dwellings, as in court No. 1, John Street; in court No. 2, Brick-kiln Street; in court No. 6, North Street; in courts Nos. 1 and 2, Horsley Fields; in several yards behind houses in Walsall Street, and in a yard in Derry Street, where they were either beneath rooms or so close to houses as to render probable the admixture of their exhalations with the atmosphere within doors. In some of these instances the more or less habitual existence of diarrhœa in the houses near the privies was clearly established. It is but right, however, to state that very active exertions have been made by the municipal authorities during the last few years to improve the condition of the town and especially to remove local nuisances, so that it was repeatedly affirmed, even of the worst districts, that their condition is greatly ameliorated. The only exception that came under notice

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was Farmer's Fold, which was reported to be now in a worse condition than formerly. This court is open and airy; the water supply is from the public waterworks; the privies are of the usual sort, but there was also a large filthy manure heap when visited. Diarrhœa had prevailed extensively in the court during the preceding summer and autumn, and all the inmates of the house opposite the nuisance had been ill with it.

There are of course some better conditioned streets in Wolverhampton, several of which were visited, but as the inhabitants were of a better class, it is evident that any comparison of the rate of mortality with that of places inhabited by the poorer classes would be open to grave objections.

BILSTON.

BILSTON, about three miles from Wolverhampton, is surrounded on all sides by mines and iron works, and black waste lands which have been used for the deposit of scoriæ and other refuse from the works. The atmosphere is almost constantly loaded with smoke; and the inhabitants consist almost exclusively of the families of persons employed in the mines and iron works, and of professional men and tradesmen, who necessarily form an integral portion of every population. Bilston contained 23,527 persons in 1851, and if the population has gone on increasing at the same rate since, as it increased between the years 1841 and 1851, it would in 1856 consist of nearly 26,000 persons. The site of Bilston is not densely occupied by buildings, and it is naturally well situated for ventilation. A considerable section of the population is located at outlying places. There is no systematic drainage at Bilston, and the surface channels are in many places so defective that water stagnates in them. This, however, partly arises from the mining operations going on below, so that the level of the ground is frequently altered by the sinking of the undermined portions. Several streets and courts, constructed since the establishment of the Local Board of Health under the Public Health Act, are well arranged and in unexceptionable condition. Bilston was formerly supplied with water from the Dudley water works; it is now supplied partly from the Wolverhampton waterworks, partly with water pumped from a mine; but the supply from Wolverhampton has only been obtained within the last year. There are also a few private wells still in use. Some of the outlying districts, as Hall Fields, are very insufficiently provided with water, which, according to the evidence of the inhabitants, is sometimes brought by hand from a distance of half a mile.

Description.

Population.

Water supply.

Cholera.

Cholera visited Bilston and proved very fatal both in 1832 and in 1849. The deaths from that disease in 1854 can have been but few, as it occasioned only 40 deaths in the entire registration district of Wolverhampton, of which Bilston forms a part. According to a statement of Mr. Bew, late Chairman of the Local Board of Health, the deaths from cholera in 1832 were at the rate of 1 in every 20 persons, or 5 per cent. on the population; in 1849 at the rate of 1 death in every 40 persons, or just half the rate which prevailed on the former occasion.

Although the number of houses in the several streets was very courteously supplied by Mr. Viles, clerk to the Local Board of Health, it has been found impracticable to make any reliable calculation of their respective rates of mortality. But it is evident from the number of deaths that have occurred in different streets that the mortality is very unequally distributed, and also, that some of them which were formerly in the worst condition, but have been much improved, are now, asregards diarrhœa, among the healthiest in the town. The evils which prevail in Wolverhampton are met with in Bilston in an aggravated form. Many of the courts were formerly unprovided with privies; and where such conveniences have been recently constructed they are usually detached from the dwellings, and were observed in very few instances to be placed beneath inhabited rooms. Privies are sometimes built against houses, and evidence was adduced that, in such situations, the liquid portion of their contents frequently percolates into the adjoining dwellings. Very often indeed privies are placed so near to dwellings that the inmates are exposed to their exhalations. The scavenging of Bilston is very imperfectly performed; considerable quantities of refuse were observed near to the houses and the effluvia from privies pervaded several of the courts. Swine are also kept in considerable numbers. Indeed, judging from observation elsewhere, many removable local nuisances unfavourable to health exist in Bilston, which perhaps produce less diarrhœal disease, than they otherwise would do, on account of the comparatively open and airy character of the place. The mortality from all causes is very high indeed, being at the rate of 29·24 per 1,000 persons.

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Sanitary condition.

WILLENHALL.—The Township of Willenhall adjoins Bilston, and contains a considerable portion of agricultural land. The town is straggling and thinly built. The population of the township in 1851 consisted of 11,951 persons, and, if it has increased at the same rate since that year as it increased between the years 1841 and 1851, it would consist of nearly 15,000 inhabitants in 1856. The inhabitants are chiefly occupied in the manufacture of locks, currycombs, and similar articles of ironmongery; but there are likewise many miners in the district which, like Bilston, is almost entirely undermined. The water supply was formerly obtained from a mine, and was distributed by a local water company; but this supply has been recently discontinued, and water is now procured from the reservoirs of the Wolverhampton Water Company. The same evils, in a smaller degree, exist as at Bilston, but the privies are here more commonly detached from dwellings than in the latter place. The diarrhœal mortality has been highest at Portobello, an outlying portion of the district, where the mortality from this disease during the five years has been at the rate of 2·2 per 1,000 persons; in the remainder of the township it has only been at the rate of 1·3 per 1,000. Portobello is inhabited almost exclusively by miners, and has around it several very foul ditches.

WILLENHALL.

Population.

Description.

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Summary.

Local conditions producing diarrhœa.

As in Coventry and Birmingham, so likewise in Wolverhampton is the existence of foul privies the most glaring sanitary defect. They are to be met with in every quarter of the district, and, although sometimes situated in less objectionable places, are too frequently stuck down close to houses or in the midst of ill-ventilated courts surrounded on all sides by dwellings. The mortality from diarrhœa in particular districts of Wolverhampton has, upon the whole, borne a direct proportion to the liability of their inhabitants to inhale an atmosphere tainted with the products of fæcal decomposition.

Although no distinct relation was traced between the drinking of impure water and the existence of diarrhœa, except perhaps in Pountney's Fold, the water from which has not been analysed, there are yet good grounds for suspecting the well water of Wolverhampton to be sometimes contaminated with organic impurities. The medical men of Wolverhampton affirmed diarrhœal disease to be not only more prevalent, but also more unmanageable in ill-conditioned places. They also referred to one circumstance which may perhaps be not altogether without influence on the diarrhœal mortality of young children. Parents, it was said, not only neglect their offspring, but also refrain from applying for medical aid to their sick children till the case has become hopeless. And even when such aid is called for, it is less with the view of procuring skilled advice than for the purpose of securing a medical certificate in the event of death.

DUDLEY.

Dudley.

Cholera in 1854.

Cholera proved very fatal to the inhabitants of Dudley, both in 1849 and in 1854. In the former of these years 412 persons died of this pestilence, in the latter 256. The history of the epidemic in the town of Dudley in 1854 affords an example, in addition to others on record, of the beneficial results accruing from sanitary precautions employed in anticipation of an outbreak of this disease. Extraordinary measures in the way of cleansing streets, courts, and dwellings, and of removing nuisances, had been adopted by the local authorities of Dudley, under the guidance of Mr. Houghton, their able and zealous officer of health, during the earlier part of 1854. Supposing the disease more likely to prevail in the town than in the country district, attention was almost exclusively directed to the former, to the comparative neglect of the outlying hamlets. Cholera prevailed in the autumn of that year nearly all round the town of Dudley. It raged with the most fearful violence at Tipton, only a short mile distant. There was such constant intercourse between the two places, that several cases were imported into Dudley from Tipton. It raged in the southern part of the parish, and also on the east, and was very fatal in some of the outlying hamlets of Dudley. A hundred and fifty deaths took place at Tipton, and forty-nine at Netherton, which contained 8,128 inhabitants, so that the deaths were at the rate of 6 per 1,000. Whilst the epidemic proved so

Prevalence at Netherton and Tipton.

fatal in the adjoining parishes, and in the outlying hamlets of Dudley, there were only at most eight or ten indigenous deaths in the town, which contained at that time a population of nearly 30,000 persons. Thus the town, with its dense population and close alleys, escaped, and the country district, with its scattered population, suffered; the town, with a population three and a half times as great, losing less than one fifth the number of persons that died from cholera in Netherton.

Diarrhœa in Dudley.

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Immunity of Dudley.

Exclusive of the deaths from cholera in the years 1849 and 1854, there were 2,719 deaths from diarrhœal disease in Dudley during the eleven years 1848–58. The average annual number during the first seven of these years was 252, during the last five 262. The population of Dudley at the census of 1851 consisted of 106,530 persons, and had probably increased to upwards of 118,000 persons by the year 1856. Assuming the correctness of the latter estimate, the rate of mortality from diarrhœal disease in Dudley, which had been 2·37 per 1,000 persons annually during the septennial period 1848–54, was 2·21 during the five years 1854–8.

Diarrhœal mortality.

Population.

Rate of diarrhœal mortality.

The Registration district of Dudley comprises the four sub-registration districts of Dudley proper, Tipton, Sedgley, and Rowley Regis. The sub-districts of Dudley and Tipton each contain a town of the same name, besides many populous outlying hamlets, which may almost be considered as little towns. Sedgley and Rowley Regis are very similar to the extra-urban portions of of the two former districts. The inhabitants of the entire district are chiefly employed in the manufacture of iron and in mining. The sanitary circumstances of the district are very similar throughout; but evils which are less injurious in the midst of a sparser population become aggravated when existing in the more densely built and closely packed population of towns. Hence, probably, arises the fact, that the diarrhœal mortality has been greater in proportion to the population of the parishes of Dudley and Tipton than of those of Sedgley and Rowley Regis. The annual average diarrhœal death-rates of the several districts, during the five years 1854–8, are in the subjoined table contrasted with each other and with that of the Registration district of which they form integral portions.

Registration District.

Rate of diarrhœal mortality in sub-districts.

Rowley Regis - -	1·44	per 1,000 persons.
Sedgley - - -	1·92	do.
Tipton - - -	2·44	do.
Dudley - - -	2·74	do.
DUDLEY - -	2·21	do.

The diarrhœal mortality of Dudley, during the five years comprised in this investigation, has been unequally distributed as regards,—

Division into Heads.

a, The different years of the period;
b, The several seasons of the year;
c, The several stages of life; and
d, The different parts of the district.

Fluctuations of diarrhœal mortality from year to year.

a. The fluctuations in the diarrhœal mortality, from year to year, are shown in the subjoined table :—

1848	240
1849*	270
1850	174
1851	250
1852	262
1853	214
1854†	358
1855	187
1856	208
1857	348
1858	208

Mortality in different months.

b. A very little more than half the deaths from diarrhœal disease happened in the autumn months of August, September, and October. With the exception of November, which is here also a fatal month, the remaining deaths were more evenly distributed over the other months of the year than has been usual in most places. If the deaths from diarrhœal disease in Dudley during the five years had amounted to 1,000, their distribution among the several months of the year would have been in the proportions stated below :—

January	46·7
February	39·5
March	50·3
April	45·2
May	46·7
June	54·0
July	40·9
August	130·7
September	224·1
October	183·2
November	85·5
December	53·2
	1000·0

Mortality at several periods of life.

c. Less than half the deaths from diarrhœa during the five years were those of infants in the first year of their age, and more than four-fifths were deaths of children under five years of age. Reckoning the deaths from diarrhœa in Dudley during the five years to have been 1,000, their distribution among the several stages of life would have been in the proportions given below :—

Under one year	477·3
One to five years	359·8
From five to sixty years	89·4
Over sixty years	73·5
	1000·0

* Exclusive of 412 deaths from cholera.
† Exclusive of 256 deaths from cholera.

The proportion of infant deaths varied somewhat from year to year. It formed 44·3 per cent. of all the deaths from diarrhœa in 1855; in 1854 and 1858, 46·1 per cent.; in 1857, 47·9 per cent.; and, in 1856, 54·8 per cent. Diarrhœa in Dudley. Dr. Greenhow's Report.

d. The rate of mortality from diarrhœa, as has already been shown, varied considerably in the several sub-districts. The sanitary state of the sub-districts Dudley and Tipton, was minutely investigated. As each of these sub-districts includes a district town, they will be best considered separately. Local distribution of mortality.

Dudley.

Dudley Sub-District.

DUDLEY consists of the town of Dudley and of several populous outlying hamlets. The ground is uneven, affording good natural facilities for drainage which have, too rarely, been made available; partly, perhaps, on account of the constantly varying level of the surface produced by the sinking down of mines. The town is densely built and includes many narrow lanes and courts, which are but too commonly in a filthy condition. The houses are sometimes in a ruinous state from the giving way of their foundations, and are often ill-constructed and badly ventilated. Privies are universal, that is to say, they are the only conveniences attached to the dwellings of the poorer classes, but each usually serves for the inmates of several houses. They are very often in close proximity to dwellings. The soil pits are often exceedingly foul, and their exhalations infect the air for some distance around. Pigs are kept in large numbers, and the filthy styes in the immediate neighbourhood of houses—sometimes against the very walls—is perhaps even a greater evil than the foul privies. A striking example of the pernicious influence of pigstyes, situated in the near neighbourhood of dwellings, upon the health of the inmates is afforded by the history of a house in Paget Yard, Stafford Street. The liquid from some piggeries in an adjoining court soaked through the wall so as to produce an intolerable stench in the house. The inhabitants have only resided there three years, and have suffered from diarrhœa both in the present and last years; they attributed the illness to the nuisance, and probably with reason, because, so far as was discovered, this is the only house in the court in which diarrhœa has occurred on either occasion. Description. Local condition associated with diarrhœa.

Dudley is very insufficiently supplied with water. There is a company which possesses powers under an Act of Parliament for supplying Dudley, Tipton, Sedgley, and Bilston with water, but the supply is very inadequate to the wants of the district, a very considerable portion of which is dependent upon springs for this necessary of life. The inhabitants of some parts of the district have to fetch water from a considerable distance, sometimes it is said as far as half a mile. The purity of some of the well water is very questionable, that of other wells appears to be of good quality. Several springs which formerly supplied populous neighbourhoods have been drained by the mining operations, and their inhabitants are often reduced to great straits for water. Water supply.

Diarrhœa in Dudley.

Dr. Greenhow's Report.

Table showing the rate of diarrhœal mortality in certain districts.

The subjoined districts have been selected to illustrate the varying rates of diarrhœal mortality in different parts of Dudley :—

Name of District.	Average Annual Number of Deaths from Diarrhœa per 1,000 Persons, during the 5 Years 1854–8.
Woodside	1·7
Dudley Wood	1·8
Netherton	1·9
Shaver's End	3·3
Snow Hill	3·6
Birmingham Street	3·6
Oakey-well Street	5·5
The Mamble	5·4
Dudley (Sub-district)	2·74

Woodside.

Woodside, a hamlet near the Woodside works, is inhabited by miners, by the people employed in the works, and by nailers. The water supply is derived from wells; the district is open, the cottages being interspersed with gardens; the privies are usually at a safe distance from the dwellings, and, although there are several nuisances such as pigstyes and foul ditches, the district is in much better condition than some other places in the neighbourhood which are naturally as well situated, but have a larger mortality from diarrhœa in proportion to the number of their inhabitants.

Dudley Wood.

Dudley Wood, with Baptist End, Windmill End, Sweet Turf, and Darby Hand, are scattered hamlets inhabited chiefly by miners; they are for the most part at a comparatively low level, but the buildings are so thinly placed that ventilation is very free; there is much unoccupied land around, some of it under cultivation, other portions black waste. The water supply is obtained partly from wells, but principally from the base of a cinder heap at Darby Hand, being, it is supposed, water that has percolated through the cinders from a canal. The privies are detached from the houses, but are for the most part of recent construction; pigs abound. Cholera prevailed in some parts of this district both in 1849 and in 1854.

Netherton

Netherton is a straggling hamlet about a mile from the town of Dudley, situated partly at a comparatively low level, but chiefly on an eminence. Between some houses at the lower portion is a ditch which receives the surface drainage from the neighbourhood. Close to its margin are several wells, from which water for dietary purposes was formerly drawn by the inhabitants of adjoining houses. The following description of this part of Netherton is quoted from Mr. Houghton's report to the Dudley Local Board of Health on the cholera epidemic of 1854 :—

"This block of building is of a triangular shape, the apex

" being formed by Beddard's provision shop, the base by the " street. The houses in the two roads (North Field and Halesowen " Roads), forming the sides of this triangle, stand on high ground, " and from the back doors of each row of houses there is a great " fall to the centre; and as the whole place is destitute of " artificial drainage, the refuse from the slopping and washing of " about 142 houses, with their pigstyes, privies, &c. &c., and one " slaughter-house, gravitates to the centre, down which an open " ditch has been dug two or three feet deep and two or three feet " wide; this ditch is filled with a fluid as thick as turtle soup and " nearly black, emitting a most offensive smell. Along the sides of " this filthy ditch a number of small wells are dug, and the water " from this ditch drains through into the wells and is used by the " inhabitants of the houses for domestic use; and indeed, so valuable " is it considered, that some of these wells were bricked, and had " wooden tops securely locked to prevent the water being stolen."

Diarrhœa in Dudley.

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The covers and locks were still attached to the wells in September 1859, when also the ditch was much less foul, but the water is no longer used for diet. The external ventilation is good at Netherton; and the privies stand apart from the houses. Water is now fetched from the base of the cinder heap at Darby Hand, described in the last paragraph. The more elevated portion of Netherton is much better kept, clean, open, airy, and naturally healthy, and there is a greater appearance of neatness about the houses. The water for diet is mostly fetched from a spring fully half a mile distant,* but there is also an open pool, kept clean by the Local Board of Health, from which water is taken for common purposes.

Primrose Hill is a detached group of buildings bordering on Netherton; it is thinly built and airy, and is stated to have been much improved since 1854, when there were several fatal cases of cholera among its inhabitants. Its present state is nevertheless still very unsatisfactory, water for diet being brought from the pump-well already mentioned as the chief source of supply to Netherton and parts of Dudley Wood district; there is no drainage; foul ditches, heaps of manure, and pigstyes abound in all directions.

Primrose Hill.

Shaver's End, Old and New Dock, and Greystone Street are so similar to some of the districts already described as to require no detailed notice. There is no drainage, and the surface channelling is bad; filthy pigstyes everywhere abound. There are privies in the vicinity of every group of houses, sometimes very near to the dwellings, but occasionally more remote. In Grey-

Shaver's End District.

* Some idea of the effects of the want of water at Netherton may be formed from the following facts related in Mr. Houghton's second annual report to the Dudley Local Board of Health :—" Mrs. S., wife of a small tradesman, residing near the Bull Inn, Netherton, says, ' We carry all our clean water in buckets from the reservoir, and we are obliged to send for it every day; sometimes we send for it three or four times a day. I have, when younger, often carried forty buckets of water in one week from the reservoir to my house.' The reservoir alluded to is near to Brewin's Tunnel, and is certainly more than half a mile from the Bell Inn, through a very hilly and bad road."

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stone Street are some privies below sleeping-rooms; each privy commonly serves for several houses. The water supply is obtained partly from wells, partly from the waterworks.

Snow Hill District.

Snow Hill district, including Badger Square and Belpor, is of a mixed character. Badger Square is an irregular, well-ventilated court, now exhibiting no obvious nuisance, but described as having formerly been in a very filthy state. Belpor is an irregular, open, ill-paved area, with several lateral branches or courts; offensive privies and filthy pigstyes are plentiful; the former are unusually built close to or even against houses, and, notwithstanding the comparative airiness of the situation, the stench pervades their immediate neighbourhood. Snow Hill has several lateral courts, some of which are in a very dirty condition, and abound in the ordinary kind of local nuisances. The water supply of this district is exclusively obtained from the public waterworks.

Birmingham Street District.

Birmingham Street district, including Porter's Field and Hall Street, is partly on a declivity. The surface is ill-tended; the privies are sometimes detached, but also very often either against house walls or in close proximity to houses. Hall Street contains many butchers' shops and slaughter-houses. The water supply is obtained partly from wells, partly from the public waterworks.

Oakey Well Street.

Oakey Well Street is narrow, and is situated favourably for drainage. Nuisances similar to those in the other parts of Dudley exist here. The water is obtained from wells.

Mamble.

The Mamble is unquestionably the worst place in Dudley. It is a court, or rather group of courts, filthy, very narrow, badly ventilated, and of irregular surface. Privies are scarce, but such as exist are most objectionably placed close to or against dwellings. The place reeks with stenches. There is tap-water in the court. The population is of the lowest kind; and the death-rate set down in the table is probably under the truth, for, doubtless, persons when seized with illness here are often removed to the workhouse, or some other place, where they breathe their last.

Kate's Hill.

So near to Dudley, as almost to form a portion of the town, is a populous district called Kate's Hill. The ground is very irregular, and the streets and houses are built in terraces one above another; there is no drainage; and several of the smaller streets not being channelled the water runs down from the surface of the road and is apt to percolate into the dwellings below. The population is chiefly composed of miners, iron workers, and nailers, and the houses are of an inferior kind. The district, as its name implies, is elevated; the natural drainage and ventilation are good; but the place is in a very filthy condition, and teems with offensive nuisances of the kind so common in Dudley, such as overcharged privies and dirty pigstyes. The water is procured exclusively from wells, which are said to be deep and to afford good water, but are sometimes as far distant as a quarter of a mile from the dwellings. No trustworthy calculation of the rate of diarrhœal mortality could be made for Kate's Hill, as a great many of the

cottages have been recently constructed, but it is probably considerably higher than the average rate of Dudley. DIARRHŒA IN DUDLEY.

TIPTON is a parish included in the Dudley Registration district, adjoining the parish of Dudley, and contains the town of Tipton and several populous outlying districts. The parish is intersected in several directions by canals and railroads. There is but little agricultural land, the surface of the soil being almost exclusively occupied by buildings, iron works, black waste, canals, and railways. The population consisted in 1851 of 24,872 persons, and probably of nearly 30,000 in 1856. The diarrhœal mortality has been at the annual rate of 2·44 per 1,000 persons, during the five years 1854–58. Cholera prevailed in Tipton both in 1849 and 1854, where it caused, according to the Registrar General, 112 deaths in the former, and, according to a local authority, 150 deaths in the latter, year. Tipton is not drained; the frequent changes in the level of the ground from the sinking down of mines, as shown by the number of ruinous and distorted houses, would, it is alleged, render drainage impracticable. Dr. Greenhow's Report. *TIPTON.* Population and rate of diarrhœal mortality. Description.

With a few exceptions in the principal town, the streets are ill-paved and so badly channelled, that water remains stagnant on them till it evaporates. Open ditches are common, and are sometimes, as in one behind Hall Street, in a very filthy state. Pigs are kept in many places, but now less commonly than in Dudley. The courts and streets, particularly in the part called "The Island," are often narrow, but are likewise frequently open at the further end, so as to allow of free ventilation. Some of the courts are dirty in the extreme, but most of them are said to have been greatly ameliorated. Houses are sometimes built back to back, and very often indeed are unprovided with means of thorough ventilation. Privies, which are comparatively rare in some of the older streets, are often a nuisance from being built against the walls or in the immediate neighbourhood of houses. The water supply is from wells which, as the mines have drained the deeper springs, are generally so shallow as to collect only surface water, and in many cases are only superficial pools, dug by the side of canal banks, into which the canal water percolates. For commoner purposes water is taken from the canals by dipping. It was said by one of the medical men, that 8,000 persons, in a particular district of Tipton, have no other source of water supply than these shallow pools fed by percolation through the canal banks. Some places, at Horseley Road and Dudley Port, are entirely destitute of water, which the people beg from neighbours, and sometimes have to fetch from a considerable distance. There are wells in the outlying district, the water from some of which appeared to be bright, clear, and of good quality. Arrangements were in progress, at the time of inspection, for supplying Tipton with water from Lichfield. Water supply.

Doubtless the rate of mortality from diarrhœal disease varies much in the different parts of Tipton; but although the clerk to the Local Board of Health readily furnished a list of the number Local distribution of diarrhœal mortality.

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of houses in several districts, it has been found impracticable to select small districts of sufficiently definite boundary to admit of trustworthy comparison by means of death-rates. It is, however, evident, from the diminished number of deaths in the last year or two in some of the streets of Tipton, such as Coppice Street, Cross Street, and Wood Street, that the local improvements recently effected have sensibly lessened the mortality from diarrhœa in certain quarters of the town; indeed, the medical men unanimously asserted that both diarrhœa and typhoid fever, which formerly prevailed almost constantly in some of these places, have become much less common. It was also said by the same authorities, that diarrhœa is more prevalent among the inhabitants of courts than among residents in the main streets. That diarrhœa does prevail either in less amount or with less intensity in certain parts of Tipton than in others is clear from the circumstance, that while this disease has proved fatal to the outlying inhabitants of Toll End at the annual rate of 1·4 and of Dudley Port at the rate of 2·0 per 1,000 persons, it has destroyed the people of Upper Green at the rate of 3·4 per 1,000 persons. Even though a considerable allowance be made for error in these calculations, they yet prove that the mortality from diarrhœa has varied much in proportion in different parts of the parish. Unquestionably, if it had been practicable to analyze the mortality of Tipton as minutely as that of several other places the existence of yet wider differences would have been discovered.

Summary.

The same general result is arrived at from an examination of the circumstances under which the diarrhœal mortality of Dudley has occurred, as has been gathered from the investigation of the several districts previously passed in review. The mortality from diarrhœal disease in different parts of Dudley, wherever it is possible to estimate its local distribution, has borne a direct proportion to the existence of nuisances tainting the air with the products of the decomposition of certain kinds of animal matter. As regards the form of nuisance, however, Dudley exhibits a marked contrast to some other places, for, although foul privies, which elsewhere appear to be the most prominent nuisance associated with fatal diarrhœa, are not unknown, they are here less frequently in immediate contact with the dwellings of the people, and another nuisance, the keeping of pigs,—a custom comparatively little practised in other places—is here very rife. It is impossible to keep pigs in the heart of a town without creating a nuisance, and that of dirty styes and heaps of manure is generally associated with the storing of half putrid wash, and with an uncleanliness of premises which the deficient water supply of Dudley must tend to foster. The co-existence of foul pigstyes infecting the air and of diarrhœa was in several instances clearly traced.

Local conditions producing diarrhœa.

The unsatisfactory state of the water-supply of Dudley may, perhaps, in some instances, operate directly in the causation of diarrhœa. No definite facts connecting the prevalence of diarrhœa in Dudley with the drinking of impure water were brought to

light in the course of the inquiry; but there was reason to suppose the well water to be sometimes tainted with leakage from the cesspools and pigstyes, and this most probably is occasionally a cause of the disease. On the other hand, the comparative but very remarkable immunity of Dudley from cholera, when that pestilence prevailed all around the town in 1854, appears to negative the supposition that tainted water is a principal cause of the prevalence of diarrhœa in that town, seeing that the ingestion of impure water is unquestionably an aggravating cause of cholera.

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Merthyr Tydfil.

Merthyr Tydfil.

Cholera occasioned 1,683 deaths in Merthyr Tydfil in 1849, and 455 in 1854. With the exception of Hull, this town suffered more severely in the former of these years, in proportion to its population, than any other place in the kingdom. Exclusive of the deaths from cholera in these two years, 1,075 persons died of diarrhœal disease, that is to say, of diarrhœa, dysentery, and cholera, in Merthyr Tydfil during the 11 years 1848-58. Of these deaths 725 occurred during the septennial period 1848-54, and 487 during the five years 1854-58, being an average of 103 deaths in each of the years 1848-54, and of 97 in each of the years 1854-58. The latter number occurred in a larger population, and does not therefore fairly represent the present amount of diarrhœal mortality in comparison with that of the previous seven years. The population of Merthyr Tydfil in 1851 consisted of 76,804 persons. It had grown very rapidly during the preceding ten years, and, if it has gone on increasing in the same ratio since, it would consist of upwards of 92,000 persons in 1856. Employing the actual population of 1851 and the estimated population of 1856 for calculating the death-rates, the average annual proportion of deaths from diarrhœal disease (always excluding the deaths from cholera in 1849 and in 1854) was at the rate of 1·35 per 1,000 persons during the seven years 1848-54, and of 1·06 during the five years 1854-58. There has thus been a manifest though small reduction in the rate of mortality during the latter as compared with the former of these periods. This amendment has been coincident with the establishment of sanitary local government in the urban districts of the Merthyr union, and with the introduction of several very important improvements. The decrease in the mortality from diarrhœa has been accompanied by a corresponding but small diminution in the general mortality, which was at the rate of 31·84 per 1,000 persons during the seven years 1848-54, and has been 29·97 during the five years 1854-58.

Cholera and Diarrhœal mortality.

Population.

Rate of diarrhœal mortality.

Rate of mortality from all causes.

The Registration district of Merthyr Tydfil is of wide extent, and comprises the four sub-districts of Gelly-gaer, Lower Merthyr Tydfil, Upper Merthyr Tydfil, and Aberdare. Of these Gelly-gaer contains no town district, and was not visited. Lower Merthyr Tydfil comprises the town of Merthyr Tydfil, Upper

Registration District.

Diarrhœa in Merthyr Tydfil.

Dr. Greenhow's Report.

Merthyr Tydfil, the town of Dowlais, now almost united to that of Merthyr Tydfil, and Aberdare, the town of the same name. The state of the public health varies greatly in the several sub-districts. The average annual rate of death from all causes and from diarrhœa for the last five years is shown in the annexed table for each district:—

Table showing the rate of mortality in the sub-districts.

Name of District.	Number of deaths from All causes per 1,000 persons.	Number of deaths from Diarrhœa per 1,000 persons.
Gellygaer	30·25	0·74
Lower Merthyr Tydfil	27·72	1·25
Upper Merthyr Tydfil	31·88	1·54
Aberdare	26·28	0·30
Merthyr Tydfil	29·97	1·06

Division into Heads.

The deaths from diarrhœa in Merthyr Tydfil during the five years 1845-8 have been unequally distributed as regards—

a, The different years of the period;
b, The different seasons of the year;
c, The several stages of life; and
d, The different parts of the district.

Variations of mortality from year to year.

a. The variations of diarrhœal mortality from year to year are shown in the subjoined list:—

1848	51
1849*	96
1850	75
1851	125
1852	124
1853	117
1854†	137
1855	93
1856	65
1857	114
1858	78

Mortality in different months.

b. The deaths from diarrhœa in Merthyr Tydfil have been more equally distributed over the year than in the places previously described. August, September, October, and November, have been the most fatal months, but less than half the deaths occurred in those four months, and not much more than a third in either the three first or the three las of them. If the mortality for the five years had amounted to 1,000, it would have been distributed among the several months in the following proportions:—

* Exclusive of 1,683 deaths from cholera.
† Exclusive of 458 deaths from cholera.

January	62·9
February	62·9
March	73·0
April	90·7
May	62·9
June	62·9
July	45·4
August	98·3
September	143·8
October	138·5
November	105·9
December	52·8
	1000·0

Mortality at several periods of life.

c. More than one-third of the deaths from diarrhœa in Merthyr Tydfil during the five years were deaths of infants under the age of one year, and more than two thirds were those of children under five years of age. If the number of deaths had amounted to 1,000, they would have been allotted to the several stages of life in the following proportions:—

Under one year	385·4
From one to five years	370·3
From five to sixty	128·5
Over sixty	115·8
	1000·0

The proportion of infant deaths varied much from year to year. Half the deaths in 1857, and considerably less than one third of those in 1854, were deaths of infants under one year of age. The exact proportion per cent in each of the years was 28·7 in 1854; 45·6 in 1855; 32·7 in 1856; 50·0 in 1857; and 38·6 in 1858.

Local distribution of mortality.

d. The mortality occasioned by diarrhœa has been unequally distributed among the several sub registration districts of Merthyr Tydfil, as shown in the table, on page 66. Small in Aberdare and in Gellygaer, the diarrhœal mortality has been largest in Upper and Lower Merthyr Tydfil. These districts deserve separate consideration.

ABERDARE Description.

ABERDARE comprises the town of that name, together with a considerable district of thinly inhabited country. A large portion of the parish is mountainous, and the hamlets are, for the most part, scattered groups of houses around the mines and iron works. The population has increased very rapidly within the last 20 years, having rather more doubled its numbers between the years 1841 and 1851. The district now under the government of a Local Board of Health, and, although still open to improvement, its condition has been much ameliorated. The buildings are scattered, and nowhere closely grouped upon the surface of the soil. All new houses are subject to regulation, and must

Diarrhœa in Merthyr Tydfil.

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be provided with proper conveniences; but although in some instances the authorities have enforced the construction of privies, the greater part of the older houses are without them. Houses are sometimes built back to back, and, even when not so placed, often have no provision for thorough ventilation; they are frequently close, the windows being rarely opened, and the upper sashes being generally fixtures; bedrooms in the older houses sometimes possess no other means of ventilation than is afforded by their communication with the adjoining apartment. Privies are usually at a safe distance from the houses, and there is a comparative absence of the nuisance, caused in more densely occupied towns, by the storing of nightsoil in the midst of the

Water supply.

population. Water was formerly scarce, but works have been recently constructed for the supply of this necessary of life to the inhabitants of the town. The whole of the outlying districts are still dependent upon the old sources for their supply of water. At Cwmbach water is taken from a little stream fed from the surface drainage of the adjoining mountain; the water is pure, and, indeed, could scarcely be otherwise, but it is sometimes scarce. At another hamlet the water is drawn from a shallow well close to a bank of small coal, considerably below the level, and not more than 20 yards distant from the adjoining canal. There is reason to suppose this well to be fed by percolation from the canal. At Treaman, a straggling hamlet, water is taken from the brook by some of the inhabitants; by others it is procured from a well at the distance of a mile. In other places water is obtained from springs on the mountain side, a channel being made so as to convey it to a spout placed in a convenient situation.

Rate of diarrhœal mortality.

Aberdare was not exempt from cholera but the diarrhœal mortality of the last five years has been remarkably small. It has been asserted that the registration of the causes of death is not very accurately performed in Wales, there may therefore be some error in the data, but if we admit these to be correct, and suppose the population to have increased since 1851 at the same rate that it increased during the preceding ten years, the diarrhœal mortality of the five years 1854-58 has only been at the annual rate of 0·28 per 1,000 persons, which is about the rate of the healthiest districts of this country. Even supposing errors to exist in registering the causes of death, Aberdare must yet be considered as singularly free from diarrhœa, which is too definite a form of disease to be mistaken; and whatever errors may exist are probably shared by Merthyr Tydfil where the rate of mortality from this disease is more than four times as high. The public health of Aberdare, estimated by the rate of death from all causes, cannot

Population.

but be considered as unsatisfactory. The population which consisted of 18,774 in 1851 would amount to upwards of 30,000 in the year 1856, if the same rate of increase were maintained

Rate of mortality from all causes.

after as previous to the census of 1851. Supposing this estimate of the population to be correct, the mortality from all causes during the five years 1854-58 was at the annual average rate of 26·28 per 1,000 persons.

No district of Aberdare appears to have suffered more than its due proportion of diarrhœal mortality during the period comprised in the present investigation. Cholera prevailed in 1849 and destroyed 185 lives. Mr. Roberts, chairman of the Board of Health, and a medical practitioner at Aberdare, who besides holding the appointment of Union medical officer for the parish, attends the work people of several of the iron works, said that privies were exceedingly rare at that time, that night soil was accumulated about the houses, and that it was in such places that cholera chiefly prevailed. In common with other districts of Merthyr Tydfil, Aberdare suffers a considerable mortality from fever. Typhoid fever was said by Mr. Jones, another medical practitioner, and assistant to Mr. Roberts, to be the prevailing form of fever, but typhus is also sometimes seen. Among the places mentioned in the Registrar General's report as being the especial seat of cholera in 1849, is Hirwain, a village, at a distance of several miles from Aberdare, and partly situated in the adjoining parish of Penderyn. Fever appears never to be absent from Hirwain, where it has produced a considerable mortality in each of the last five years. The worst parts of Hirwain, those in which cholera chiefly prevailed in 1849 and where fever is said more especially to show itself, are Mill Street or Heol-y-felin, and arch-houses or Tai-yr-arches. The former is a short narrow street, of cottages built back to back, and but little elevated above the level of the river. The street is ill kept, the floors of the houses are formed of "concrete," and each cottage consists of a kitchen with the small close bed-room opening from it, so commonly met with in the older cottages of Wales. The window being a fixture, the small bed-room has no ventilation excepting from its communication with the kitchen. Over all is a loft, sometimes used as a bed-room, and which is reached by a ladder. The Arch-houses are at least equally objectionable; in the lower part are arches upon which the upper portion of the structure is supported. These arches have been converted into dwellings, each consisting of two rooms. They are very gloomy, and their only ventilation is by the door. There are in the basement of the structure twelve dwellings of this description. The houses above the arched dwellings form one side of a narrow, dirty, ill-kept street, terminated at one end by a high bank and wall impeding ventilation. The houses above the arches have back windows, but those on the opposite side of the street are without. The bed-rooms have no fireplaces, and their windows do not usually open. There are no privies for either Mill Street or Arch-houses and water is fetched from a distance. There had been much rain at the time of visit, but both places were reported to be in general exceedingly foul, and indeed must necessarily be so.

DIARRHŒA IN MERTHYR TYDFIL.

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Cholera in Aberdare.

Typhoid fever.

at Hirwain.

LOWER MERTHYR TYDFIL comprises the town of Merthyr Tydfil and an outlying portion of the parish containing several considerable hamlets grouped around the iron works. The town is not densely built but contains some narrow ill-ventilated courts.

LOWER MERTHYR TYDFIL.

Description.

Diarrhœa in Merthyr Tydfil.

Dr. Greenhow's Report.

Water supply.

The water supply has hitherto been quite inadequate to the requirements of the population, and it is derived principally from pools and wells sometimes situated at a considerable distance from the consumer. A spout communicating with the fish pond in front of Cyfarthfa Castle, which consists of water collected to afford water power to the Cyfarthfa works, is the source of supply to a considerable population; another section of the population derives its supply from a pond fed by a streamlet in Pen-y-darran Park. In other places water is obtained from wells, as in Picton Square, where is a pump of reputed good water or from "spouts," at some of which the people have to wait for it a considerable time. The water for many houses on the Cardiff road is obtained from a shallow well by the side of a "cinder tip" heap of scoriæ and refuse. There are no privies to the adjoining houses, and ashes, night-soil, and other refuse are cast on to the tip. The water did not appear to be contaminated, but, to say the least, the arrangement was a dangerous one. Water is also sold from carts which perambulate the town.* This defective state of the water supply will, however, very shortly be rectified, as water works are now in course of construction.

Sanitary condition.

The main streets are now in good condition, but are said, on all hands, to have formerly been in a very filthy state. Privies are the only kind of conveniences attached to the cottages of the working classes, and they are of comparatively recent origin. Ten years ago, it is said, there were not a dozen privies for the use of the whole working population of Merthyr and Dowlais; but many have been recently constructed, and they are generally detached from the houses. These conveniences are still scarce in some parts of the district, and a few places, such as Pontmorlais, Quarry Hill, parts of Cae-draw and of Plymouth Street, are without them. The night soil at Pontmorlais is cast into the Morlais brook, which is sometimes very sluggish and offensive from the impurities thrown into it. The privies and cesspools are emptied at the cost of the owner at an expense of 5*s.* per cubic yard; the ashes and other refuse are now removed daily at fixed hours by scavengers' carts Notwithstanding this, some of the smaller streets and back alleys were in a filthy condition, heaps of refuse lying in the vicinity of dwellings. Stenches are said to abound in certain parts of Merthyr in sultry weather.

Local mortality from diarrhœa

The mortality from diarrhœa has been very equally distributed

* The following account of the water supply of Merthyr is quoted from a Report of the Sanitary Condition of the Parish to the Local Board of Health, by Dr. Kay, their temporary medical officer of health :—"Under ordinary circumstances the great body of the labouring classes resort to the springs and spouts, or *pishtyllion*, as they are locally called, of which there are ten in Merthyr, four in Pen-y-darran, and from six to eight in Dowlais; but many of these either entirely fail or yield a very scanty supply in dry weather and during the warmer months of summer; at the very season in fact when it is most required. Nor does the trouble, time, and labour of procuring it, even in insufficient quantity, from the distance at which these spouts are situated in reference to many of the dwellings, entail a slight burden upon the class in question. At almost all hours of the day, from morning till night, and even occasionally late in the night itself, may be seen numerous parties assembled round the spouts waiting in turn to fill their jugs or pitchers."

throughout Merthyr and does not materially exceed the general average in some of the worst parts of the town. Cae-draw, which comprises a well-defined district, inhabited partly by the lowest class of the population, and which contains some very narrow, illventilated, and dirty courts, has lost not quite at the rate of two persons per 1,000 from diarrhœa on an average during each of the last five years. The water supply is described as good, but privies are rare, and the refuse is chiefly cast into the river or removed in the scavengers' carts. In fact, there has only been one death from diarrhœa in the two years 1857 and 1858, during which the place has been more carefully cleansed; so that, if these two years were deducted from the five, the mortality during the three years 1854–5–6 would be close upon three in the 1,000; that, during the period the cleansing has been in operation, almost inappreciable. The mortality in the district of Pen-y-darran during the same five years has not exceeded 1·7 per 1,000 persons. Pen-y-darran is an airy, straggling hamlet, consisting of several rows of houses and short streets. There are privies of recent construction detached from the dwellings; water is obtained from a spring in the field behind Pen-y-darran Park. The diarrhœal mortality appears to have been most considerable in proportion to the population at Pentrebach, a hamlet at some distance from Merthyr Tydfil. As nearly as can be estimated the mortality here has been at the average rate of more than three per 1,000 per annum, but the place is straggling and it was found difficult to define it with sufficient accuracy for statistical purposes.

Diarrhœa in Merthyr Tydfil.

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The village of Cefn-coed-Cymmer, which is just outside the limits of the parish of Merthyr Tydfil, but is comprised in the Registration district, exhibits a remarkably low rate of mortality from diarrhœa. A census of the population has been kindly furnished by Mr. Taylor, surveyor of the Local Board of Health. The present population, according to this census, consists of 2,479 persons, and, supposing it not to have fluctuated materially during the last five years, the mortality from diarrhœa has, during that time, been at the average annual rate of 0·4 per 1,000 persons, being about the rate which prevails in the healthiest rural districts. Even if the population should have doubled during the last five years, which is most improbable, the death-rate would still be remarkably small. The village is pleasantly situated on moderately high ground overhanging the Taff-fechan, a branch of the Taff, and consists of one long principal street, and of several shorter lateral ones. The houses are mostly old; and the streets are clean, although not under the government of the Local Board of Health. Privies are very rare, and no obvious nuisances were observed. All refuse matters, it is said, are thrown into the river. The water supply is obtained partly from the river, partly from springs on the mountain. Mr. Wills, a medical man, who chanced to be in the village at the time of inspection, said there had been an unusual amount of diarrhœa among the inhabitants during the present autumn (1859), and that he had seen from 150 to 200 cases, not one of which had proved fatal. It is worthy of notice

Small rate of diarrhœal mortality at Cefn-coed-Cymmer.

Diarrhœa in Merthyr Tydfil.

that fever has been nearly four times as fatal as diarrhœa to the inhabitants of Cefn-coed-Cymmer during the last five years.

Dr. Greenhow's Report.

UPPER MERTHYR TIDFIL includes the town of Dowlais, which is 500 feet higher than that of Merthyr Tydfil. Cholera was exceedingly fatal here in 1849. The population was not very different in amount from that of Lower Merthyr Tydfil, yet the deaths from cholera in that year were more than twice as numerous, being 935 in Upper, and 454 in Lower Merthyr Tydfil. Dowlais is a long, straggling, irregular town, situated upon a declivity which is in some places very steep. The population is more entirely composed of the working classes than that of Merthyr Tydfil, where the professional and trading classes chiefly reside. The buildings are by no means densely packed together, and there are several streets and rows of houses of recent construction and of a better class; many of the older houses are much dilapidated, frequently overcrowded, and in their rear, and in other places out of the direct thoroughfare, are often heaps of refuse and other nuisances. Many of the older houses are built against the hill side, which renders them damp. Privies are a recent innovation, for ten years ago they scarcely existed among the dwellings of the working classes, and they are still too few, many of the older houses being without them. Although scavengers' carts go round daily, much refuse and filth is accumulated in the town, which would undoubtedly render it still more unhealthy but for its lofty and airy situation. Little deposits of night soil abound in some of the courts, and in one of those visited a square covered gutter full of it was pointed out. The night soil was formerly cast into the roadways, and much of it is still either disposed of in the same manner or thrown into the dustbins. The cesspools attached to the privies are said to be tapped when full, the contents being allowed to run into a hole dug in the earth for that purpose.

UPPER MERTHYR TYDFIL.

Cholera.

Description of Dowlais.

Local sanitary condition.

The worst conditioned parts of Dowlais are Cae-Harris, at the upper end of the town, and some courts and houses in a very filthy state behind the "Plough" Inn, near the bottom of the town. Where privies have been constructed, they are generally placed at a safe distance from the dwellings, and are less objectionable than they would be in a denser built, less open, and more purely urban place. Water is obtained from shallow wells by the side of the "cinder-tips," or heaps of scoriæ and refuse from the works, and is also sold from perambulating carts, which bring it from a distance of two miles. Both the diarrhœal and general mortality are higher in Dowlais than in Lower Merthyr Tydfil, a fact probably attributable in part to the more exclusively working character of the population of the former place, but also, as regards diarrhœa, to the irregularity of the ground and the carelessness of the inhabitants rendering thorough cleansing more difficult, so that a greater number of nuisances, infecting the air with the products of organic decomposition, exist in the higher than in the lower district. As in other places of a high mortality, infants suffer

Infant mortality.

in a large proportion from the unhealthy condition of the place. From the investigations of Dr. Kay, the temporary medical officer of the Local Board of Health, it appears that the mortality of children is considerably greater in Upper than in Lower Merthyr Tydfil.

Diarrhœa in Merthyr Tydfil.

Dr. Greenhow's Report.

Fever came so prominently under notice in Merthyr Tydfil that, although not forming a special part of the present inquiry, the facts relative to it may, perhaps, not improperly be related.

Fever.

The annual average fever death-rate of the Registration district of Merthyr Tydfil, during the septennial term 1848–54 was 2·07 per 1,000 persons. The number of deaths from fever registered in each sub-district during the last five years has been extracted from the death registers for the present inquiry. The average annual death-rate from fever during the last five years, calculated from these data, amounted to 1·70 per 1,000 persons in the whole Registration district of Merthyr Tydfil. The mortality has not been uniform, but has varied considerably in the several sub-districts, having been at the rate of 2·42 per 1,000 persons in Gellygaer; 1·48 in Upper Merthyr; 2·18 in Aberdare; and 1·01 in Lower Merthyr. Bearing in mind the reservations already made with reference to calculations based upon an estimated population, and that the causes of death are perhaps registered somewhat carelessly, these figures may be accepted as affording at least an indication that the mortality from fever has decreased in the Registration district since the earlier calculation, and that the decrease has in all probability occurred mainly in the districts of Upper and Lower Merthyr, where active improvements have been effected. They also show, no doubt, with tolerable accuracy, the different prevalence of fever in the several sub-registration districts. From the evidence of the medical men, confirmed by personal observation, the prevalent form of fever is that now known by the name of typhoid fever, and it is estimated that one case in ten proves fatal.

Rate of mortality from fever in sub-districts.

A group of fever cases was seen at Troed-y-rhiw, a hamlet beautifully situated in a picturesque valley several miles from Merthyr. Their beginning could not be satisfactorily traced. The houses in which the cases occurred were not overcrowded, but were very imperfectly ventilated. The bed-rooms have no chimneys, the upper sashes of the windows did not open, and the lower were not hung, so that when opened, which seldom happens, it is necessary to prop them up. The rooms were close and offensive, indeed oppressively so, a common attribute of the dwellings of the poor in this part of Wales, which are generally badly ventilated, and on that account, even when in other respects cleanly, unpleasant to strangers. This applies more particularly to modern cottages, for the rough, picturesque, but comfortless looking old Welsh cottages, with their high-peaked roofs of thatch, wide hearths, and open chimneys, are, as a general rule, much less close and unpleasant than the neater and apparently more comfortable modern dwellings. The first cases were seen in Wyndham Street, in the rear of which on either side, and at a distance of not more than fourteen or fifteen yards from the backs of the houses, is a

Typhoid fever at Troed-y-rhiw.

Diarrhœa in Merthyr Tydfil.

Dr. Greenhow's Report.

foul stagnant ditch, into which the privies empty themselves. These ditches are said to be most offensive in summer, but were not particularly so at the time of visit, owing probably to heavy rains which had fallen during several previous days. Wyndham-Street lies at a comparatively low level, and is damp. Several cases of fever were said to have occurred up and down the street, but many houses had altogether escaped, although placed under exactly similar sanitary circumstances to those in which fever had occurred. A well-marked case of typhoid fever was seen in one of the houses in which there had previously been two other cases, then convalescent. In another house, where a fatal case had already occurred, a second case (also of typhoid fever) was under treatment at the time of visit. The room in which the patient lay stank with the concentrated exhalations from the skin and lungs, consequent upon the entire absence of ventilation. The only access to it was by a narrow circular staircase from the kitchen, shut at top and bottom by doors, whilst the absence of a chimney, and the constantly closed window, almost entirely excluded the fresh air; in other respects the room was beautifully clean. The people in this house complained much of the smell from the ditch. Patients, in different stages of the disease, were seen in several other parts of the same neighbourhood. Amongst others, in three well-situated houses on the Cardiff Road, which is at a higher level than Wyndham Street. Two of these houses are situated immediately over, and not more than ten yards in a direct line from one of the ditches already described as receiving the soil from the privies in Wyndham Street. The water supply is obtained from a "spout" on the mountain side by the inhabitants of Wyndham Street and of Cardiff Road; it is pure, and indeed its contamination with any kind of organic matter, excepting what it may collect in its passage down the face of the hill, is impossible, seeing that the mountain side is uncultivated, overgrown with heather and other wild plants, and has no house or other building in the direction whence the water issues. Another well-marked and severe case of typhoid fever—that of a young man aged 21 years—was seen in New Street; the room was close, the window shut, and there was no chimney. The water drunk here is drawn from a well in a garden, at a sufficient distance from the house and privy to be free from all risk of contamination, but it is not more than eight feet deep, or distant more than twelve feet from a stagnant ditch, which, however, does not receive the contents of privies. The fever cases seen or heard of at Troed-y-rhiw were not concentrated in one place, but scattered about here and there; they could not be traced to communication with one another, either by means of direct intercourse or through the privies.

Summary.

The most remarkable fact in the history of diarrhœa in Merthyr Tydfil, is the very different distribution of mortality throughout the year from that which has prevailed in the towns previously reported on, a circumstance probably due to some climatic peculiarity. In other respects the disease appears to be attributable in Merthyr Tydfil to causes analogous to those in other places already described,

such as the defilement of courts and lanes, caused by the rarity of privies, and the existence, particularly in Dowlais, of numerous collections of offensive refuse. Its connection with these causes seems especially indicated by two facts, detailed in the preceding pages; viz., the greater mortality in Upper than in Lower Merthyr, and the comparative immunity of Cefn-coed-Cymmer. Upper is less efficiently cleansed than Lower Merthyr, and contains a larger amount of offensive refuse. The fæcal and other waste matters are all effectually got rid of in a very primitive manner at Cefn-coed-Cymmer, being cast into the river, so that little or none remains either within doors, or in the immediate neighbourhood of the houses. The atmosphere is consequently free from the products of fæcal or other organic decomposition, and the water drunk by the inhabitants is also, in this respect, perfectly unexceptionable.

Diarrhœa in Merthyr Tydfil.

Dr. Greenhow's Report.

Merthyr is said to be now unlike its former self, so great is the improvement, especially in street cleanliness, which has been effected by the Local Board of Health; yet there are defects which, in a more densely built and thickly-peopled town, could scarcely fail to aggravate the already large mortality, and especially to increase that occasioned by diarrhœa. A more complete removal of these defects, the introduction of an abundant supply of pure water now in contemplation, the more thorough removal of nuisances, and the doing away with cesspools from the vicinity of dwellings, would unquestionably very materially reduce the amount of diarrhœal mortality. There is, in fact, no reason, either from its situation, its climate, or the character of its population, why the rest of Merthyr Tydfil should suffer more largely from this disease than Cefn-coed-Cymmer.

Improved condition of Merthyr Tydfil.

Nottingham.

Nottingham.

Cholera caused a very inconsiderable mortality in Nottingham in the epidemic years 1849 and 1854. In the former of these years the deaths were only 18 in number, in the latter 16, whilst as many as 15 deaths are recorded in the Death Register of 1851, in which year cholera was not epidemic in this country. Including the deaths from cholera, diarrhœal disease, that is to say, diarrhœa, dysentery, and cholera, caused 1,405 deaths in Nottingham during the eleven years 1848-58. Dividing the eleven years into two unequal periods, each including the year 1854, and consisting of seven and five years respectively, the average annual number of deaths from diarrhœal disease in Nottingham in each of the seven years 1848-54 was 121; in each of the five years 1854-58, 147. There has thus been an increase in the average number of deaths produced by this class of diseases in the latter period, as compared with the former; and if the year 1854 be excluded from the earlier calculation, the increase in the later period is even more marked, the average

Diarrhœal mortality.

Diarrhœa in Nottingham.

Dr. Greenhow's Report.

Population.

number of deaths in the six years 1848-53 having been only 112, whilst that of the five years 1854-58 has been 147. Doubtless, this increase is partly attributable to the increase of population, which is said to have been more rapid since than it was previous to the census of 1851. But even making every allowance for increase of population, the diarrhœal mortality of Nottingham has been greater of late years. Nottingham contained 58,419 persons in 1851, and if the population had increased at the same rate after as it did during the ten years preceding the census of that year it would have consisted of more than 61,000 persons in 1856. But as the excess of births over deaths, which was only 3,089 during the ten years which elapsed between the years 1841 and 1851, has been 4,029 during the eight years 1851-58, the population has probably increased more rapidly since than previous to the last census. The increase of the population of Nottingham during the ten years 1841–51 was 5,328 persons, of which number 3,089 may be considered as the natural increase, being the excess of births over deaths; the remainder, consisting of 2,239 persons, must have been caused by immigration. The increase from immigration was, therefore, in the proportion of 72·4 per cent. on the natural increase. The nearest approximation to the present population of Nottingham may probably be arrived at by adding the natural increase, that is, the excess of births over deaths during the five years 1851-56, and 72·4 per cent. upon the natural increase to the actual population of 1851. According to this calculation, Nottingham would contain nearly 63,000 persons in the year 1856. Adopting this estimated population for calculating the death-rate for the five years 1854-58, and the actual population of 1851 for calculating the death-rate of the seven years 1848-54, it results that the annual diarrhœal mortality of Nottingham during the earlier period was at the rate of 2·08; during the later period, at the rate of 2·34 per 1,000 persons. The diarrhœal mortality of Nottingham would thus appear to have increased within the last five years, and although the increase is but fractional, it at least seems to show that the causes of this disease continue in undiminished force. This is the more remarkable, as the authorities of Nottingham have paid unremitting attention to the sanitary state of the district under their supervision. The general rate of mortality has kept even pace with the diarrhœal mortality. Employing the same divisors, viz., the actual population of 1851 and the above estimated population of 1856 for the calculation, the annual rate of deaths from all causes was 27·08, during the seven years 1848-54, and 28·72 per 1,000 persons during the five years 1854-58.

Rate of mortality from diarrhœa.

Rate of mortality from all causes.

Description.

Nottingham is a compact, closely-built town, containing but few open spaces within its original area. The arrangement of the streets is complicated, and the interspaces are occupied by courts and alleys, which are in general narrow and confined, and therefore imperfectly ventilated. The streets are clean and in good condition, and most of the courts are paved. The courts and alleys are cleansed by the municipal authorities, and are from

time to time, especially during the summer season, flushed with water by means of a hose attached to the water-plugs. Houses built back to back are common here, as in other towns in the Midland Counties; the front houses of a row often opening into the main street, the back into a court in its rear. It is stated in the Report of the Sanitary Committee for 1849, that Nottingham contained about 8,000 back to back dwellings at that time. The entrances of the courts are frequently through narrow archways. Nottingham is partially surrounded by land, upon which, until recently, no buildings could be erected, a circumstance which had the twofold effect of causing the site of the town to be more densely covered with buildings, and of adding a considerable portion of unoccupied land to the Registration district. Hence the density of the population, which is stated in the Report of the Census Commissioners for 1851 to be at the rate of 19,994 persons to a square mile, does not correctly represent the manner in which the inhabitants of Nottingham are aggregated upon the surface of the soil.

Diarrhœa in Nottingham.

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The water supply of Nottingham is almost exclusively derived from the works of the Nottingham Water Company, and is taken partly from the River Trent, partly from wells sunk in the red sandstone. The lower portion of the town, including all the streets beneath its level, is supplied with water from the Park Row Reservoir, which is fed chiefly with water taken from the Trent; the upper portion with water from the Bellevue Reservoir and the Basford Well, which are both entirely fed by water pumped from wells. The following is Professor Miller's Report of an Analysis of samples of water taken on October 1, from the Trent Works, from the Park Row Reservoir, and from the Bellevue Reservoir:—

Water supply.

I. Analysis of Water from the Reservoir at the Trent Works, Nottingham.

Analysis of public water from Trent works,

Hardness before boiling (Clark's scale) -	19°·9
Hardness after boiling 1 hour - -	9°·0
Specific gravity - - - - -	1,000·59
Solid contents in grains per imperial gallon:—	
Fixed salts - - - -	45·80
Volatile and combustible matter - -	0·96
Total solid matters - -	46·76
Nitric acid - - - - -	0·32
Ammonia - - - - -	0·027
Cubic inches of gas per gallon:—	
Carbonic acid - - - -	9·60
Oxygen - - - - -	1·86
Nitrogen - - - -	3·97
Total quantity of gases in solution	15·43
Proportion of oxygen to nitrogen - -	1:2·08

Dr. Greenhow's Report.

from Bellevue Reservoir,

II. Analysis of Water from the Bellevue Reservoir, Nottingham.

Hardness before boiling (Clark's scale)	11°·8
Hardness after boiling 1 hour	5°·2
Specific gravity	1,000·14
Solid contents in grains per imperial gallon:—	
Fixed salts	16·00
Volatile and combustible matter	0·88
Total solid matters	16·88
Nitric acid	1·30
Ammonia	0·027
Cubic inches of gas per gallon:—	
Carbonic acid	7·69
Oxygen	1·85
Nitrogen	4·48
Total quantity of gases in solution	14·02
Proportion of oxygen to nitrogen	1:2·42

from Park Row Reservoir.

III. Analysis of Water from the Park Row Reservoir, Nottingham.

Hardness before boiling (Clark's scale)	17°·8
Hardness after boiling 1 hour	7°·7
Specific gravity	1,000·38
Solid contents in grains per imperial gallon:—	
Fixed salts	26·80
Volatile and combustible matter	1·72
Total solid matters	28·52
Nitric acid	2·57
Ammonia	0·027
Cubic inches of gas per gallon:—	
Carbonic acid	8·92
Oxygen	1·97
Nitrogen	4·32
Total quantity of gases in solution	15·21
Proportion of oxygen to nitrogen	1:2·19

Of these waters, that from the Bellevue Reservoir is the best; they are all well aerated, and contain lime and magnesia as their principal bases. That from the Bellevue Reservoir is the softest, and it is freer from organic impurities and sulphates eitherthang of the others.

The water from the Trent Works is merely the filtered river water; that from the Park Row Reservoir is mixed, consisting

chiefly of the Trent water, but containing also a portion from the Castle Works, and sometimes from Basford; that from the Bellevue Reservoir is drawn entirely from wells sunk in the red sandstone. The water is generally drawn direct from the taps, the supply being constant, but until recently was also sometimes received into cisterns sunk in the ground. The water in the latter was apt to become impure, a fact well illustrated by the history of three local outbreaks of cholera in Nottingham.

Diarrhœa in Nottingham.

Dr. Greenhow's Report

The first of these is thus related in one of the annual reports of the Sanitary Committee:—"In the beginning of December "1849 five fatal cases occurred in Brewitt's Yard, Albion Street. "The first case was in a house situate near to some very offen- "sive privies, and the second in a house partly over another "set of privies. It appeared in evidence, at an inquest held over "the body of one of the persons who died, that the supply of "water, (which was obtained from a well or underground brick "cistern), was impure, and on examination it was found that "the bottom part of the cistern was lower than the bed of the "adjacent main sewer; that the cement was worn off the bottom, "and that the sewer water found its way in small quantities into "the cistern." The court was visited and found to be now in excellent order. There has been very little sickness in the court lately, and, so far as was ascertained, no diarrhœa.

Impure water a cause of cholera.

The second outbreak occurred in Platt's Yard in 1850, and is thus described in the Report of the Sanitary Committee for that year:—"In September last several rapidly fatal cases occurred in "the neighbourhood of Gedling Street, the symptoms of which "were of such a malignant character as to create great alarm, not "only in the immediate neighbourhood, the inhabitants of which "complained of many grievous nuisances, but also in the town at "large." Amongst other local nuisances, it was found "that the "water with which most of the inhabitants of the locality were "supplied was obtained from an old well in Platt Court, into "which offensive matter from the adjacent sewers drained through "the ground."

The third case occurred in Foundry Yard in 1854:—"The "attack was local; the first patient was taken ill on Thursday, "November 23, and recovered. On the following Monday "four persons in the same part of this yard were seized with this "disease, and died on the following day, and many other persons "residing in the same yard were taken ill, and died in rapid suc- "cession." "The disease did not spread beyond the yard, nor "appear in any other part of the town. On an examination of "the locality, with the view as far as possible to ascertain the "cause of so sudden and concentrated an outbreak, your Com- "mittee came to the conclusion that the water in this yard used "for drinking was foul, and was the cause of the disease. The "water cisterns were of brick, and sunk in the centre of the "yard; they had first been emptied and cleansed out, and, on "being re-examined, a black deposit was observed at the bottom "of one of them, which was found to proceed from the adjoining

Diarrhœa in Nottingham.

Dr. Greenhow's Report.

" drain." Foundry Yard is now in good condition, open at both ends, and has for the use of the inhabitants of about 40 houses three sets of privies, which are placed between blocks of houses. Notwithstanding the improvements which were made after the outbreak of 1854, the mortality from diarrhœa has continued to be excessive. The inhabitants are now supplied with water from taps, the old cistern being disused.

Sanitary condition.

Until within a few years the common privy and cesspool were the only conveniences attached to the dwellings of the poorer classes. So recently as 1854 it was stated in the Report of the Sanitary Committee that manydwelling houses were still unprovided with privies; in the Report for 1856 that "66 houses situated in "Brook Street, Bromley Street, Tyler Street, and Pump Street, "which hitherto have been entirely destitute of such conveniences, "are now provided with privies of the best construction;" but it is added, "so closely built is this part of the town, that these "improvements could only be effected by taking down three "dwelling houses, in order to provide a site for erecting the "privies." In the Report for 1857, it is said that arrangements had been made for the erection of privies for the use of the inhabitants of a considerable number of small tenements in Trumpet Street, Rumford Street, Commerce Street, and Cyprus Street, which had not hitherto had any proper conveniences. Formerly privies frequently existed beneath inhabited dwellings, and, indeed, although a great many have been removed by the authorities, a few of this objectionable kind still remain. Although a considerable number have been converted into cheap and effective water-closets, privies still exist in close and dangerous contiguity to houses, and the contents of their cesspools sometimes leak through into dwellings. The courts of Nottingham are often exceedingly narrow and confined, few of them being really airy. Of course wherever noxious exhalations exist, this character of the courts retards their dispersion into the atmosphere. It is but justice to the Town Council to state that great attention is bestowed by them upon the sanitary condition of the town, the superintendence of which is entrusted to a special committee; that in many cases houses have been purchased and pulled down in order to open out and promote the ventilation of courts; that attention is paid to the removal of nuisances; and that although many sanitary defects continue in operation, much more than is common has been done for the improvement of the town.

Division into Heads.

The diarrhœal mortality of Nottingham during the five years comprised in this enquiry has been unequally distributed as to—

a. The different years of the period;
b. The different seasons of the year;
c. The several periods of life; and
d. The different parts of the district.

Variations of diarrhœal mortality from year to year.

a. The variations of diarrhœal mortality from year to year are shown in the subjoined list:—

1848	58
1849	125
1850	92
1851	140
1852	128
1853	129
1854	179
1855	66
1856	92
1857	221
1858	169

Mortality in different months.

b. Rather more than two-thirds of the deaths from diarrhœal disease during the five years took place in the autumn months of August, September, and October; and considerably more than half in the two months of August and September. Reckoning the deaths from diarrhœal disease in Nottingham during the five years to have been 1,000, their distribution among the several months of the year would be as follows:—

January	20·4
February	22·0
March	27·2
April	25·8
May	10·9
June	36·7
July	97·9
August	272·1
September	272·2
October	131·9
November	58·5
December	24·4
	1,000·0

Mortality at several periods of life.

c. More than half the deaths from diarrhœa during the five years were deaths of infants in the first year of their age, and very nearly three-fourths were deaths of children under five years of age. Next to infants diarrhœa was most fatal to the elderly, more than one-seventh of the deaths having occurred to persons over sixty years of age. The mortality between the ages of five and sixty years has been exceedingly small, having very slightly exceeded one-tenth of the entire mortality. If the deaths from diarrhœa in Nottingham had amounted to 1,000, their allotment to the several stages of life would be shown in the subjoined table:—

Under one year	608
From one to five years	136
From five to sixty	105
Over sixty years	151
	1,000

DIARRHŒA IN NOTTINGHAM.

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The proportion of infant deaths fluctuated considerably from year to year; it formed 69·0 per cent. of all the deaths from diarrhœa in 1854; 67·7 per cent. in 1856; 58·3 per cent. in 1855 and 1858; and 54·2 per cent. in 1857.

Local distribution of mortality.

d. The deaths from diarrhœa have been unequally distributed in the different parts of Nottingham, but the inequalities in the death-rates are less marked than in some other places. This perhaps arises less from the absence of variations in the proportion of mortality caused by diarrhœa in the several districts of the town, than from the difficulty of isolating particular districts at once sufficiently well defined, sufficiently small, and yet large enough to afford data for calculating the rate of death in a reliable manner. Sometimes, as in the Millstone Lane District, the existence of common lodging houses would render deceptive any attempt to estimate the population of a given area by the average number of persons to a house. Again, places in which diarrhœa has prevailed are, on the one hand, too small to afford trustworthy data, and, on the other, to add them to a larger area would mask the result. And still more frequently the complicated arrangement of the courts, and the uncertainty in assigning the locality of deaths, would render altogether futile any attempt to arrive at an accurate computation of the rate of mortality. The three subjoined districts, which are the most definite that could be selected, show that the diarrhœal mortality of Nottingham has varied in different quarters of the town; but as they certainly do not represent the healthiest, so likewise it is probable that they by no means represent the unhealthiest districts:—

Table showing the rate of mortality from diarrhœa in certain districts.

Name of District.	Average Annual Number of Deaths from Diarrhœa per 1,000 Persons, during the 5 Years 1854–8.
Sheridan Street - -	2·6
Trumpet Street - - -	3·1
Pomfret Street - -	3·1
NOTTINGHAM - - -	2·34

Sheridan Street District.

Sheridan Street District includes Pipe Street, Brewery Street, Wood Street, Dennis Street, New Charles Street, and Gedling Street, several of which have been repeatedly under the notice of the Sanitary Committee, which has made many efforts for their improvement. The houses are generally built back to back, and the inhabitants are of a very poor class. The privies, formerly often beneath inhabited rooms, have been improved, houses having sometimes been taken down to make way for their reconstruction, by which means a dangerous nuisance has been abated, and the

privies being only one story in height, a freer ventilation of the streets has been effected.

Trumpet Street District comprises Trumpet Street, Commerce Row, Rumford and Cyprus Streets. Nearly all the houses in these streets are built back to back, but the streets are open at one end to the cholera cemetery of 1832, and at the other to an open space set apart by the corporation for a public playground. The mortality has been greatest in Rumford Place, which has on its opposite sides two large groups of privies serving for the inhabitants of Commerce Row and Cyprus Street, as well as for those of Rumford Place. It has been very inconsiderable in North Row, which is in good condition, and has waterclosets for the use of the inhabitants; yet, although these facts seem to show the tendency to an excess of diarrhœal mortality in streets affected by the effluvia from privies, much importance cannot be attached to this particular case, since it appeared by no means certain that the inmates of the houses nearest to the privies had suffered in an undue proportion. The mortality has occurred almost exclusively in epidemic years, and there were no deaths from diarrhœa in this district in 1855.

Pomfret Street, Stanhope Street, and Earl Street, form a district very similar in character to the Trumpet Street district, the houses being back to back and the privies on the sites of former, and all but contiguous to existing, houses. It is, perhaps, worthy of notice that in these very similar groups of streets, situated at a considerable distance from one another, the diarrhœal death-rate is identical, as though similar conditions were attended by a like result.

Of smaller districts diarrhœa has been very fatal in Foundry Yard, Lees Yard, Leenside, Albion Street, Sherwood Street, Glasshouse Street, and York Street.

Foundry Yard, where, excepting in 1858, in which only one death from diarrhœa appears in the death registers, several deaths have taken place annually, has already been referred to in connexion with the cholera outbreak of 1854. There are three sets of privies almost in juxtaposition to neighbouring houses, which are said to be often in a very foul condition, in consequence of the filthy habits of the inhabitants. In other respects, the court is now in good sanitary condition. The old cistern has been discontinued, water being taken direct from the taps. There is a common lodging house in the court, which renders it difficult to ascertain the exact number of inhabitants; but making a large allowance for this circumstance, the mortality during the last five years has been at the annual average rate of 7·5 per 1,000 persons.

Lees Yard. The mortality here also has been considerable; but there was no death from diarrhœa in the court in 1858. The houses are often back to back, and their ground floors below the level of the street; the privies are detached, but in a very foul state, and the property is of the worst description, and inhabited by a very low class of persons. As nearly as can be estimated,

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the mortality from diarrhœa has been at the annual average rate of 5·0 per 1,000 persons during the five years 1854-58.

Leenside.

Leenside is a broad airy street, the houses are of a superior character, and the inhabitants not of the poorer class. It is situated at a low level, and is drained into a stream, the Leen, now covered over and converted into a sewer, which receives a very large portion of the sewage of Nottingham. One side of the street consists principally of wharves which render the street open, but more exposed to the offensive exhalations proceeding from the stagnant water of the canal, which is very impure. The foul and offensive state of the canal has repeatedly occupied the attention of the authorities, and formed the subject of several negociations with the Canal Company. The remainder of the above-named streets are so similar to some already described, as to require no special notice.

Local conditions producing diarrhœa.

The occurrence of diarrhœa in places pervaded by the odour of foul privies, was frequently ascertained. Diarrhœa has prevailed in Bear Court, an ill-kept yard, surrounded on three sides by lofty houses. The privies are situated in a small yard behind the court, directly below the windows, and their offensive condition was strikingly apparent at the time of the inquiry. The privy in Sherwood Lane is built against house No. 35; the house, consisting of three rooms and a workshop, is occupied by a mechanic, his wife and six children, who have resided in it twelve years, and have suffered more or less from diarrhœa every year. This case is the more conclusive, as the persons who have lived upwards of 30 years in the adjoining house have been entirely free from the disease, which has so often attacked their neighbours. Near the entrance of Salmon's Yard is a foul cesspool, of which both the inhabitants and Mr. Fox, the Union medical officer, complained as an intolerable nuisance. Mr. Fox says, that fever and diarrhœa have been very common in the court; and a house-to-house inquiry revealed that diarrhœa in particular had been most prevalent in such houses as were nearest the nuisance. But perhaps the most remarkable illustration of the subject now under consideration is

Smith Square.

afforded by the history of an outbreak of diarrhœa in Smith Square, Pierrepoint Street, a square paved court blocked up at the end by a wall nearly twenty feet in height. The range of privies which serve for this and the adjoining court, called Pott's Square, are underneath an uninhabited house in one corner of the court. The exhalations from the privies infected the atmosphere of Smith Square during the hot weather of last summer, the wind at the time blowing from a quarter which carried the odour from Pott's Square into Smith Square. Diarrhœa prevailed at that time in only one house in Pott's Square; but, with two exceptions, in every house in Smith Square. These exceptions were two houses sheltered from the direct current of the effluvia by a low building. Several of the cases were exceedingly severe; one of them commencing as diarrhœa, passed into fever, and proved fatal. Prompt measures were taken by the authorities for the removal of the nuisance, and are stated by Mr. R. Brudenell Carter, one of

the Union medical officers, who kindly directed my attention to this place, to have been speedily followed by a cessation of the disease. The privies were being converted into waterclosets at the time of inspection. It is worthy of notice that diarrhœa and fever prevailed in Pott's Court last year (1858), the fever was of the kind called typhoid, which is the prevalent form of fever in Nottingham, and several other instances of its existence in connexion with similar nuisances come under notice in the course of the present investigation. The immediate connexion of one of these with a local nuisance is so clear as to deserve being placed on record. The privies at the end of Union Place, Glasshouse Street, together with those of an adjoining court, are so placed as to be a serious nuisance to the inhabitants of two houses. The inmates of one of these have lived there five years. Two years since five members of the family were ill from fever, accompanied with diarrhœa; the fever was evidently of the typhoid kind, a fact which may be inferred from the existence of diarrhœa, but was also confirmed by a description of the other symptoms. One of the cases proved fatal. It may perhaps be surmised that the disease in this instance might have been introduced by contagion; and it is not impossible that such was the case; but if so, it is very remarkable that a precisely similar outbreak took place next year in the adjoining house, and that the outbreaks were limited to the inmates of the two houses exposed to the foul effluvia, and did not spread among the other inhabitants of the court; to say the least, the coincidence is remarkable.

Diarrhœa in Nottingham.

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Union Place.

The authorities of Nottingham appear to have habitually noted the connexion between diarrhœa and local nuisances, and whenever the disease has prevailed, have employed active measures for purifying the affected district. An outbreak of severe and often fatal diarrhœa occurred in August, 1851. The fatal cases were found, on enquiry, to have been persons residing in dwellings situated in the neighbourhood of some offensive nuisance. The infected houses were forthwith limewashed when requisite, and the streets and courts flushed with water from the fire plugs. Indeed it is impossible to speak otherwise than in terms of praise of the exertions that have been made by the municipal authorities of Nottingham for the sanitary improvement of the town. It is true, that much remains to be done, especially as regards the condition of the privies and the drainage; but a great deal has already been effected by the conversion of offensive privies into water closets, and by widening and opening out narrow streets and courts. That these efforts have been less successful than might have been expected, and that the mortality from diarrhœa has rather increased than diminished of late years, is, in all probability, due to the town being densely built, to the still prevailing use of privies; and as each of these conveniences serves for several houses, to the accumulation of large quantities of night soil in the midst of the population, and in the immediate vicinity of their dwellings. Perhaps it is because these evils are common to the greater part of

Diarrhœa in Nottingham.

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Nottingham, that although diarrhœa has been sometimes more fatal in certain parts of the district, it has yet, upon the whole, been more generally diffused throughout the town than in some other places comprised in the present enquiry, a fact not only brought to light by the present investigation, but also confirmed by the testimony of the medical men.

Comparative immunity of Narrow Marsh from diarrhœa.

To this rule there have doubtless been several exceptions, two of which are sufficiently remarkable to deserve notice. If the courts connecting it with Leenside be excluded, only four deaths from diarrhœa have occurred during the last five years in Narrow Marsh, a long narrow street, closely shut in on one side by a perpendicular cliff in the rear of the houses, the other side abutting upon some of the worst and densest courts of the town. The four deaths caused by diarrhœa in this street all occurred previous to 1857. If the population of Narrow Marsh could be accurately estimated, the diarrhœal death-rate would be very small. The other example referred to is that of several streets constructed upon the recently enclosed land in the suburbs. In four of these streets, viz., Plantagenet Street, New Mowbray Street, and Berkeley Street, only four deaths from diarrhœa have occurred since 1854. Probably these streets were not entirely finished until some time after 1854; but this mortality is, nevertheless, extremely small. These streets are, in every sense of the word, model streets, and the houses are of the best kind, and in excellent condition. They vary a little in design and size, to admit of variations of rent; are inhabited by respectable workpeople, and are exempt from the evil which prevails so commonly throughout the other portions of the town, the privy or water closet being always placed at a distance of several yards from the rear of the houses.

Plantagenet and other streets.

Summary.

Considering the unusually energetic exertions made during many years by the municipal authorities of Nottingham to promote its sanitary improvement, it certainly might have been hoped, perhaps even expected, that the public health of the town would be materially improved, and that the deaths from diarrhœa in particular, a disease, the prevalence, or perhaps to speak more correctly, the intensity of which is so intimately connected with local impurity, would have largely decreased. This, however, has not been the case, for, even though the population should have been estimated at too low a figure, the fractional excess of mortality in the later, as compared with the earlier period, referred to above, probably affords a sufficiently wide margin to leave the rate at about the former standard.

The sole cause assigned by the local medical practitioners for the high diarrhœal mortality of Nottingham was the mismanagement of young children. Infants, it is said, are very often left by their mothers when at work in charge of old women, whose practice it is to administer opiates. The children are also frequently dry nursed, the ordinary substitutes for the natural diet being bread and water, arrow root or sago. Mr. Brudenell Carter stated the diarrhœa of infants in Nottingham to be of the dysenteric form, a statement which tallies very closely with what was reported in

Coventry, where the medical men also described the same complaint as presenting the dysenteric character. The management of infants would seem to be very similar in both towns.

Diarrhœa in Nottingham.

But the primary and most influential cause of the high diarrhœal mortality of Nottingham is, undoubtedly, the existence of foul privies, and the consequent accumulation of nightsoil, infecting the air with the products of its decomposition in the midst of a dense population. This nuisance is increased by the practice of grouping several privies together, as where houses have been pulled down to make room for the construction of these conveniences for the use of entire courts or streets; and the evil is yet further augmented by the fact that each privy usually serves for several houses. And round these common privies the diarrhœa has been more especially grouped. The evil is much aggravated by the dense compactness of the town, which concentrates the accumulations of excrement into a smaller compass, and brings it into closer proximity with the dwellings of the inhabitants. It is obvious from the sanitary history of Nottingham, that however much the construction of privies, where such did not previously exist, may add to the comfort of the population, no means will effectually improve the public health as regards diarrhœa, which does not provide for the prompt removal of ordure from the midst of a thickly peopled town.

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Local conditions producing diarrhœa.

Leeds.

Leeds.

More than 1,400 deaths were caused by cholera in Leeds in 1849. The deaths from diarrhœa and dysentery in that year of epidemic visitation, although considerably more numerous than in ordinary years, were yet fewer than occurred in 1852. Exclusive of the deaths from cholera in 1849, but including those of 1854, which were only 48 in number, nearly 3,000 deaths from diarrhœal disease, that is to say, from diarrhœa, dysentery, and cholera, occurred in Leeds during the eleven years, 1848–58. Dividing the eleven years into two unequal periods, each including the year 1854, the average annual number of deaths from diarrhœal disease, exclusive of the cholera mortality of 1849, was 294 in each of the seven years, 1848–54, and 234 in each of the five years, 1854–58. There has thus been a marked decrease in the average number of deaths from diarrhœal disease in Leeds during the last five, as compared with the seven preceding years; and as the diminished mortality has occurred among a larger population, the decrease has of course been larger in proportion to the number of the inhabitants. The population of Leeds consisted of 101,343 persons in 1851; if it has maintained the same rate of increase since that year as it maintained during the ten years 1841–51, Leeds must have contained nearly 109,000 persons in 1856. Using these numbers, the actual population of 1851, and the estimated population of 1856, for calculating the

Diarrhœal mortality.

Population rate of diarrhœal mortality.

Diarrhœa in Leeds.

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rate of mortality of the two periods in proportion to the population, it appears that the annual average death-rate from diarrhœal disease, always excluding the deaths from cholera in 1849, was 2·91 per 1,000 persons during the seven years 1848–54, and 2·17 during the five years 1854–58. The general mortality of Leeds has likewise decreased from the rate of 31·16 deaths per 1,000 persons during the earlier, to 27·18 during the later period. Thus the diminished mortality from diarrhœal disease has been coincident with a corresponding decrease of deaths from all causes, so that either the last five years have been singularly healthy, or the improvement in the public health of Leeds must be attributed to some change of local circumstances.

Rate of mortality from all causes.

Description of registration district and of own.

The registration district of Leeds includes a considerable quantity of ground in the suburbs as yet unoccupied by buildings, and also the straggling but populous hamlets of Sheepscar, Buslingthorpe, Woodhouse Carr, and Great Woodhouse. As these less densely occupied districts have been included in the general area in estimating the superficial density of the population, this appears less in Leeds than it really is, for the central portion of the town is very thickly covered with buildings.

Leeds is of course traversed by certain principal streets; but these are fewer than is common in other great towns, and the interspaces between these principal roads are occupied by dense and often complicated congeries of narrow ill-kept streets and courts, which have but seldom been adopted as highways by the municipal authorities, are often in a very foul state, and, according to Mr. Sanderson, the local inspector, are neither kept in order nor cleansed at the public expense. Many of these bye-streets are neither paved nor drained, and very often they are so imperfectly channelled that surface water remains stagnant on them until dried up by the influence of the sun and wind. Sometimes these streets have no outlet at the further end, being in fact mere *culs de sac;* more frequently they communicate one with another so as to form a complicated labyrinth of very imperfectly ventilated little streets and courts. Houses in such situations are very commonly indeed built back to back, and even when not so they are often destitute of windows in the rear, and possess no efficient means of thorough ventilation. The streets of Leeds have in fact been laid out, and the houses erected, according to the caprice or interest of their owners, without reference to the health, comfort, and convenience of the inhabitants, or to the fact that they were destined to form integral parts of a great town. The courts of Leeds are rarely spacious and airy, are sometimes entered through covered passages, and are by no means always clean, but more frequently are unpaved and in bad condition. Privies are almost universal, and are from their position in relation to dwellings the most prominent sanitary defect of the town, water closets being unknown among the poorer classes. As is common in other manufacturing towns, a single privy usually serves for several families. The situation of the privies is often most objectionable; in many of the smaller streets they are placed beneath inhabited rooms; in

Sanitary condition.

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others they are sometimes placed either against the walls of houses or so near to them that the effluvia are felt within doors, and infect many of the courts and smaller streets. Although certainly not the exclusive cause of diarrhœa, yet upon the whole that disease has been most rife and most fatal in streets where the privy nuisance prevails in an aggravated form. On the other hand, there are rows of houses occupied by the labouring classes, identical in all respects excepting this, with districts in which diarrhœa has prevailed, in which not a single death from diarrhœa has occurred during the whole five years included in the present enquiry.

Cellar dwellings are rare in Leeds, and such as exist are by no means strikingly objectionable.

Water supply.

The water supply of Leeds is chiefly derived from the public water works, but also partly from wells, especially in the outskirts of the town and suburban districts, as Buslingthorpe.

A sample of water taken from the principal reservoir on October 7, was transmitted to Professor Miller for examination, the report of whose analysis is here given :—

Analysis of public water.

Analysis of Water taken from the Public Reservoir at Leeds.

Hardness before boiling (Clark's scale) -	8°·3
Hardness after boiling one hour - -	3°·5
Specific gravity - - - -	1000·19
Solid contents in grains, per imperial gallon:—	
Fixed salts - - - -	12·08
Volatile and combustible matter -	2·72
Total solid matters - -	14·80
Nitric acid - - - -	0·44
Ammonia - - - -	0·03
Cubic inches of gas per gallon:—	
Carbonic acid - - -	5·17
Oxygen - - - -	1·87
Nitrogen - - - -	4·91
Total quantity of gases in solution	11·95
Proportion of oxygen to nitrogen -	1·262

The water is slightly calcareous, and softens on boiling. It contains a considerable quantity of organic matter easily acted on by oxidizing agents. The water is well aerated.

Division into Heads.

The deaths from diarrhœa in Leeds during the five years, 1854–58, comprised in this enquiry, have been unequally distributed as to ;—

a, The different years of the period;
b, The different seasons of the year;
c, The several periods of life; and
d, The different parts of the district.

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a. The variations of diarrhœal mortality from year to year are shown in the subjoined table, from which it appears that epidemics of this disease prevailed in 1852, and in 1857 and 1858, as well as in the years 1849 and 1854 :—

Fluctuations of diarrhœal mortality from year to year.

1848	243
1849*	334
1850	204
1851	294
1852	386
1853	270
1854†	331
1855	148
1856	184
1857	258
1858	251

Mortality in different months.

b. Two-thirds of the deaths during the five years occurred in the months of August, September, and October ; and more than half of them in the months of August and September. October and July, in the order in which they are placed, have been, after August and September, the most fatal months of the year. Calculating the deaths during the five years at 1,000, they would be apportioned among the several months of the year in the following manner :—

January	21·7
February	27·2
March	21·7
April	22·6
May	31·6
June	38·8
July	101·4
August	273·0
September	282·0
October	118·4
November	33·4
December	28·2
	1000·0

Mortality at several periods of life.

c. More than half the deaths from diarrhœa in Leeds during the five years were deaths of infants below the age of one year, and more than three-fourths were deaths of children who had not arrived at five years of age. The mortality between the ages of five and sixty years was so small, that less than one-tenth of all the deaths occurred to persons of intermediate ages, between childhood and old age. The actual number of aged persons who died of diarrhœa was also inconsiderable, since it fell short of an

* Exclusive of cholera, which caused 1,436 deaths.
† Including cholera, which was fatal to 48 persons.

eighth of the entire mortality, but as the number of persons aged sixty years and upwards in the population of Leeds, at the last census, was to the number of children under the age of five years only as two to five, the actual mortality in proportion to the number of aged persons living was, in reality, more considerable than at first sight may appear. If the proportion of persons of the several periods of life in Leeds be the same now as it was in 1851, then is diarrhœa but little more than twice as fatal to young children as to elderly people. Reckoning the deaths from diarrhœa in Leeds during the five years, 1854–58, at 1,000, their distribution among the several periods of life would stand as follows: —

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Under 1 year of age - -	535·5
From 1 to 5 years - -	250·5
5 to 60 years - -	92·0
Over 60 years - -	122·0
	1000·0

The proportion of infant deaths varied somewhat from year to year. It was smallest in 1854, when only 47·8 per cent. of the deaths were those of children under one year of age. It was largest in 1855 and in 1857, in the former of which years 55·0 per cent., and in the latter 60·4 per cent. of the deaths were those of infants under the age of one year.

d. The mortality from diarrhœa has been unequally distributed to the different parts of Leeds. It appears to have been very high in some of the smaller streets and courts; so high, in a few cases, as six or seven deaths per 1,000 persons annually; but the number of the population, and of the deaths in such cases, was much too small to afford sufficient assurance of the trustworthiness of the calculations. These places have, therefore, been excluded from the subjoined table, which shows the average annual rate of mortality from diarrhœa per 1,000 persons during the five years, 1854-58, in several districts of Leeds selected for the purpose of comparison.

Local distribution of diarrhœal mortality.

Table showing the rate of diarrhœal mortality in certain districts.

Name of District.	Number of Deaths from Diarrhœa per 1,000 Persons.
Templar Street - -	2·1
Banner Street - - -	2·2
Castle Street - - -	2·4
Quarry Hill - - -	2·4
Mill Street - - -	3·5
Camp Field - - -	3·8
Leeds - - - -	2·17

Owing to the peculiarly complicated arrangement of the streets and courts, and to the difficulty of assigning the deaths to their

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exact position, it has been found difficult to construct a table which would show the extreme variations of mortality in different parts of Leeds. Each district in the above table includes some better conditioned streets and courts, as well as the worse conditioned places. Doubtless the rate of mortality varies very considerably in the several streets of each district contained in the table. Indeed there can be no question, that if the mortality of each district could be satisfactorily analysed, it would be found that whilst that of some streets is very much below, that of others is very much in excess of the rate prevailing in the district of which they here form integral parts. A short description of each district will suffice.

Templar Street District.

Templar Street District is bounded by Lady Lane, North Street, Byron Street, Millright Street, Hope Street, and Moscow Street. It comprises 49 streets, lanes, and courts, the greater part of which are of small extent. Templar Street, the principal of the group, consists of only 89 houses, and the three next in size, Byron Street, Hope Street, and Bridge Street, respectively consist but of 71, 66, and 65 houses. Portions of the district are open and airy, and some of the streets are inhabited by persons of a better class. Several, as Trafalgar Street, are well kept, but these cannot be dissevered in statistical calculations from the worse conditioned districts with which they are intimately connected, and which are filthy in the extreme, being unpaved, undrained, uncleansed, and infected with the effluvia from privies. Here and there privies have been constructed under the same roof with dwelling houses, as in Malt Street, Templar Court, and Moscow Street, and occasionally even beneath inhabited apartments. As such privies usually serve for three or four adjoining houses, the atmospheric condition of the contiguous houses in sultry weather may be readily surmised.

Banner Street District.

Banner Street District comprises a group of streets inhabited by artisans; the houses are mostly back to back, but free from obvious nuisances. The streets are drained and clean, but unpaved and private, not having been declared highways by the authorities. This district affords a good illustration of the better kind of streets occupied by the working classes of Leeds. It is also a district of definite boundary and character, and the rate of mortality is more reliable than might be supposed from the comparative smallness of the population, which is under a 1,000.

Castle Street District.

Castle Street District consists of an irregularly triangular block of streets, of which Little Queen Street forms the base, and Wellington and West Streets to their junction the sides; they are all private streets, not having yet been adopted by the municipal authorities. The district consists of several narrow and one or two broader streets, with courts in their rear. They present a favourable specimen of the streets inhabited by the working classes of Leeds. Some of the courts are in good condition, others quite the reverse; but with the exception of Howarth's, Hardisty, and Hinchliff Courts, where these conveniences are either in close contiguity to houses, or built actually under the same roof with

them, the privies are for the most part sufficiently distant from the dwellings. The mortality appears to have been evenly distributed over the district, which is very compact, and the death-rate is in all probability tolerably correct.

Quarry Hill District.

Quarry Hill District includes High Street, Charles Street, St. Anne's Lane, Boynton Street, Cornhill, Shear Street, the Line Streets, and the several back streets and courts connected with them. The population is chiefly composed of the poorer class of working people; the streets are mostly private, that is, are neither maintained nor cleansed by the municipal authorities. Parts of the district are represented as having recently been much improved; and although others, as Charles Street and High Street, are still in bad condition, the greater portion of the district is perhaps in as good order as its defective construction and arrangement will allow. The mortality in Charles Street and High Street is considerably greater than in the rest of the district, the average annual rate being as nearly as can be estimated, 4·4 per 1,000 persons in Charles Street, and 3·2 in High Street. These streets being withdrawn from the area, the average annual rate of mortality from diarrhœa during the five years in the remaining streets has been a little under 2·0 per 1,000 persons. Although much importance cannot be attached to the fact, that the rate of death from diarrhœal disease in these streets is much larger than in the surrounding district, with which they are so intimately connected, yet it is remarkable that the higher rate of mortality has prevailed in the two worst conditioned streets of the district, a circumstance which appears to indicate an intimate connection between a high diarrhœal mortality and district uncleanliness.

Mill Street District.

Mill Street District is bounded by Mill Street, Marsh Lane, Railway Street, and Richmond Road, and includes several short streets, which have no outlet at the further end. The principal difference between this group of streets and some of those already described, is the greater prevalence of the privy nuisance. In other respects, several of these streets are in good condition, others are in a bad state, unpaved, undrained, and with ill-formed channels, which suffer water to remain stagnant until it evaporates.

Camp Field District.

Camp Field District is a well-defined and isolated block of streets, surrounded on all sides by vacant ground. The inhabitants are entirely of the working class; the houses are sometimes built back to back; and although the privies are detached from the houses, they are generally situated in confined, ill-ventilated yards and courts. In the rear of the front houses are several populous courts, of small size, in which the privies are much too near the dwellings to be compatible with either comfort or health.

Summary.

Local conditions producing iarrhœa.

The principal cause of the excessive diarrhœal mortality in Leeds is unquestionably the state of the privies, which here, as in Nottingham, are often contiguous to houses, each serving in general for a whole court, or at least for several dwellings. Judging from experience elsewhere, it is most probable that if the diarrhœal death-rate of small districts in different parts of Leeds could be

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accurately determined, it would be found to vary greatly, and would sometimes be very large. On the other hand, the incorporation of several populous outlying hamlets in the registration district probably lessens its diarrhœal death-rate; for nuisances likely to be very prejudicial to health in the midst of an area densely covered with buildings, may, perhaps, be tolerated with comparative impunity in more thinly-occupied districts. While much remains to be accomplished for the sanitary improvement of Leeds, it is gratifying to observe that the more energetic removal of nuisances recently practised has been attended by a decrease in the diarrhœal mortality. There seems, indeed, no reason why the mortality from this disease should not be yet more largely diminished, if a more perfect system were adopted, for speedily removing the ordure of the inhabitants from the midst of the town.

Manchester.

Manchester.

Population.

Portions of the three registration districts, Manchester, Chorlton, and Salford, combine to form the great manufacturing and commercial town of Manchester. Their joint population, in 1851, consisted of 439,937 persons, and had probably increased to upwards of half a million in 1856. Although constituting but one town, they are under two separate municipal governments; those of the city of Manchester and of the borough of Salford. Other portions are suburban, and not included under the local government of either corporation. The three districts will be more conveniently considered separately.

Manchester Registration District.

MANCHESTER REGISTRATION DISTRICT comprises a large portion of the city of Manchester, together with the outlying townships of Newton, Bradford, Crumpsall, Failsworth, Moston, Harpurhey, Blackley, Prestwich, and Great and Little Heaton. Cholera occasioned 891 deaths in Manchester in 1849, but visited it very lightly in 1854; indeed, the deaths from cholera, dysentery, and diarrhœa were more numerous in Manchester in 1852, when cholera was not supposed to be epidemic in this country, than in 1854, when it prevailed severely in an epidemic form in several parts of England. Excluding the 891 deaths from cholera in 1849,

Diarrhœal mortality.

but including those in other years, 7,032 persons died of diarrhœal disease; that is to say, of diarrhœa, cholera, and dysentery, in the registration district of Manchester during the eleven years 1848-58. Of these deaths, 4,924 occurred during the seven years 1848-54, and 2,836 during the five years 1854-8; being an annual average of 703 during the earlier, and of 567 during the later period. The deaths from diarrhœa have thus materially decreased of late years; and, as the population has increased, the

Population and rate of death

diminution in proportion to the number of inhabitants is even larger than is represented by these figures. The population of

Manchester in 1851 consisted of 228,433 persons; and if it afterwards increased at the same rate as it had done during the ten previous years, the number of its inhabitants would amount to about 249,000 in 1856. Supposing this estimate to be correct, the average annual death-rate from diarrhœal disease, which was 3·20 per 1,000 persons during the septennial period 1848-54, had fallen to 2·28 during the five years 1854-8, or nearly one-third. This decrease in the diarrhœal death-rate has likewise been coincident with a diminution in the mortality from all causes, which has fallen from an annual average of 32·90 per 1,000 persons during the septennial period 1848-54, to 30·56 during the five years 1854-58. Satisfactory as is this great reduction in the mortality from diarrhœa in Manchester, there yet remains a wide margin for improvement, seeing that the present death-rate from this disease is more than seven times higher than the normal rate. There can be little hesitation in attributing this improvement in the public health of Manchester, more especially as regards diarrhœa, mainly, if not exclusively, to the efforts made by the civic authorities to amend the sanitary state of the city.

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from diarrhœal disease.

Rate of death from all causes.

Manchester is a densely built town; the interspaces between the streets being small, and almost entirely covered with buildings. It is, indeed, true that the number of persons per square mile in the registration district of Manchester is considerably smaller than in several other large towns, but this arises from the wider area of suburban land attached to Manchester. Birmingham, for example, although much less closely built, has a population density more than three times as great as that of Manchester, according to the ordinary mode of calculation, because the district is almost purely urban, and does not include the thinly-built suburban districts.

Description.

The streets and courts of Manchester are, generally speaking, well kept and cleanly, the little heaps of refuse so commonly to be observed in most towns being here found only exceptionally. During a very minute inspection of the town, but few places were observed requiring notice, on account of their filthy condition. One of these is a vacant plot of ground behind Style Street, formerly used as a burial ground, but now applied to all sorts of vile purposes; others are vacant spaces in the rear of Pollard Street, and in the front of Swallow Street, and Gibraltar, a very low neighbourhood, abounding in heaps of manure and refuse. These, together with a few small courts and back passages, were in this respect the only strikingly exceptionable places observed. Courts abound in the interspaces between the streets, and are often narrow, ill-ventilated, and, being sometimes entered under an archway, are so entirely surrounded by buildings as to form mere wells of stagnant air, which is often rendered offensive by the effluvia from privies. Indeed, these latter form the prevailing nuisance of Manchester. Although apparently well looked after, they cannot fail, more especially in close, warm, still weather, to be a source of great annoyance to the inhabitants; and, if their influence on the public health may be

Sanitary condition.

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judged of by experience in other places, they are one of the primary causes of the prevalence of diarrhœa. Privies are the only kind of convenience attached to the dwellings of the labouring classes, water-closets being apparently discountenanced by the local authorities.

Regulations as to waterclosets.

It is stated in the official regulations published by the Sanitary Committee of the Council, "that water-closets will only be allowed "under special arrangements with the Committee, and the owner "or occupier agreeing with the Water Works Committee for water, "for the purpose of cleansing the pipes; also defraying one-half of "the cost of removing the ashes." Privies are, therefore, in general use; in the older portion of the town, where they did not formerly exist, their construction has been enforced in the proportion of one privy for every four houses; and, when necessary, houses have, it is said, been removed, to afford room for their construction. Every recently built dwelling-house is provided with a privy and ash-pit. Very stringent regulations have been adopted on this subject by the civic authorities, it being laid down

Regulations as to privies.

in the regulations already quoted, that "every dwelling-house to "be built within the borough shall be provided with a privy and "ash-pit, which shall be constructed in a yard attached to the "premises, but not in front of any house, and over which privy "or ash-pit no bed-room or sleeping-room shall be built, and the "premises shall be so arranged that water shall not flow into the "ash-pit." "The minimum inside dimensions of privies are, "1st, depth or length from front to back, 3 feet 6 inches; "2d, breadth, 2 feet 6 inches; 3d, height (average), 6 feet 4 "inches." "The entrance to the privy shall have a step of not "less than two inches of a rise from the ground or passage "immediately adjoining, and the floor of the privy shall be flagged, "and shall have an inclination towards the passage of half an inch "to the foot. The minimum inside dimensions of ash-pits must

Regulations as to ash-pits.

"be 4 feet by 3 feet, or 3 feet 11 inches by 3 feet 2 inches, or "4 feet 4 inches by 2 feet 9½ inches." "Ash-pits must be drained "to the satisfaction of the Committee, and the passages to privies "or ash-pits must be at least 3 feet in width, in old property, "and not less than 3 feet 6 inches in new property."

Great density of buildings.

It results from these regulations that in laying out ground for building purposes, the space between the backs of parallel rows of houses is usually just sufficient to admit of the construction of privies, ash-pits, and passages in accordance with the requirements of the Sanitary Committee. In some instances, the space is not even quite enough to comply with the spirit of the law, although the letter be scrupulously adhered to. In one part of Chapel Street, where houses have been built according to the above recited regulations, the space between the back of one row of houses, and that of the opposite row, does not exceed thirteen feet; the two sets of privies, the ash-pits and the passage, being all compressed into that space. The same holds good in Paris Street, Heyrod Street, and other places, in some of which,—the ground being too narrow even when the narrow width of the privies and ash-pits is place

parallel to the houses,—half the thickness of the house wall, has been borrowed, in order that the privy may be of the size required in the regulations, thus leaving only $4\frac{1}{2}$ inches of wall between the privy and the adjoining room. In such cases, and indeed generally, the space occupied by the privy intervenes between the house and the cess-pool or ash-pit. The cases last mentioned are, it is true, extreme, and not exactly common cases, but it is the custom to leave no extra space between rows of houses which are built only sufficiently far apart to allow of compliance with the strict letter of the law, so that next to the house is the privy, then the ash-pit, between which and the ash-pit of the opposite house a space not exceeding from $3\frac{1}{2}$ to 4 feet intervenes. In a considerable number of streets the width between the backs of opposite rows of houses within which are comprised the two sets of privies and ash-pits, and the back passage, does not exceed from 14 to $14\frac{1}{2}$ feet. Sometimes there are rooms over privies, as in George Leigh Street, Back Hardiman Street, Bengal Street, Mitchell Street, Pott Street, Jordan Place, Lees Street, Back St. Michael's Place, Nuttall's Court, and Warrener's Buildings. There is usually in such cases a ventilating shaft or flue for carrying away the exhalations from the privy to the open air, the flue constructed for this purpose sometimes passing through the rooms above the privy. In other places, perhaps of more recent construction, a space for the dispersion of effluvia is left between the top of the privy and the floor of the room above; examples of this arrangement are met with in the neighbourhood of Brown and Caledon Streets. Small sculleries with bed-rooms over them, are occasionally erected, as projections from the backs of houses; these interfere materially with the passage of the air through the interspaces behind the houses, the ventilation being often so impeded that offensive exhalations are but slowly dispersed into the general atmosphere.

Narrow space between backs of streets.

When it is considered that this system of constructing privies in very confined spaces is common throughout Manchester, it may well be termed the monster sanitary defect of this important city. This evil, curiously enough, is less conspicuous in the older than in the newer portions of the town; for, although the older houses are often loftier, and occasionally let out in tenements of a single room each, the yards are usually larger, and the privies often less objectionably placed than in the more modern streets. Pigs were observed in a few places, but by no means commonly. Strictly speaking, the keeping of pigs in the town is not prohibited; but whenever complaints are made concerning them, their removal is ordered; and, practically, this has almost sufficed to banish them from the denser portions of the city. Many cellar dwellings are found in Manchester, and often the houses stand back to back with each other. The water supply is almost, if not entirely, obtained from the public waterworks. Samples taken on October 26th, were transmitted to Professor Miller, whose analysis is here given.

Water supply.

Anaylsis of Water taken from the Gorton Public Reservoir, Manchester.

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Analysis of public water.

Hardness before boiling (Clark's scale) -	3°·3
Hardness after boiling one hour - -	3°·3
Specific gravity - - - -	1,000·12

Solid contents in grains, per imperial gallon :—

Fixed salts - - - -	6·36
Volatile and combustible matter - -	2·04
Total solid matters - - -	8·40
Nitric acid - - - -	0·29
Ammonia - - - -	0·04

Cubic inches of gas per gallon :—

Carbonic acid - - -	0·87
Oxygen - - - -	2·90
Nitrogen - - -	6·99
Total quantity of gases in solution -	10·76
Proportion of oxygen to nitrogen - -	1 : 2·37

This water is well aerated, and very soft. It contains a sensible quantity of organic matter, chiefly of a peaty nature.

Division into Heads.

The deaths from diarrhœa in Manchester have been unequally distributed as regards—

a. The different years of the period;
b. The different seasons of the year;
c. The several stages of life; and
d. The different parts of the district.

Fluctuations of diarrhœal mortality from year to year.

a. The number of deaths in each of the eleven years is shown in the subjoined list :—

1848 - - -	644
1849* - - -	900
1850 - - -	678
1851 - - -	494
1852 - - -	937
1853 - - -	543
1854 - - -	728
1855 - - -	449
1856 - - -	492
1857 - - -	695
1858 - - -	472

b. More than half the deaths took place in the months of

* Exclusive of 891 deaths from cholera.

August and September, and more than two-thirds in the months of July, August, and September. Reckoning the deaths during the five years at 1,000, they would be distributed among the several months of the year in the following proportions :—

Mortality in different months.

January - -	20·2
February - -	19·7
March - -	25·2
April - -	20·9
May - - -	32·2
June - - -	42·2
July - - -	146·5
August - -	321·9
September - -	221·8
October - -	99 0
November - -	31·0
December - -	19·4
	1,000·0

Mortality at several periods of life.

c. Nearly two-thirds of the deaths were those of infants under one year of age, and considerably more than four-fifths those of children who had not attained the age of five years. If the deaths during the five years comprised in this investigation had amounted to 1,000, they would have been distributed among the several stages of life in the following manner :—

Under 1 year - - -	603·1
From 1 to 5 years - -	273·6
,, 5 to 60 - - -	68·7
Over 60 years - - -	57·6
	1,000·0

The proportion of infant deaths varied considerably in different years; the percentage of infant deaths was 57·6 in 1854, 62·0 in 1855, 50·5 in 1856, 54·4 in 1857, and 59·6 in 1858.

Infant mortality.

The proportion of infant deaths also varied in the several registration districts, having been much larger in the town districts than in Newton, Cheetham, Failsworth, Blackley, and Prestwich, which are termed in the subjoined table the five suburban districts. The differences in the urban districts may, perhaps, be partly due to the varying proportion of young lives in different sections of the population; and the comparatively small number of children's deaths in Market Street district is undoubtedly partly caused by the circumstance that deaths of persons, both in the workhouse and infirmary, are registered in this district. Reckoning the deaths during the five years in each sub-registration district at 1,000, the subjoined table shows the proportion borne by the deaths of children under one year, and between one and five years of age, to the whole diarrhœal mortality :—

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Table showing the proportion of children's death in sub-districts.

Name of District.	Under One Year.	One to Five Years.
Ancoats - - -	603·7	285·1
Dean's Gate - - -	636·1	269·7
London Road - - - -	638·5	279·6
Market Street* - - -	510·1	253·0
St. George's - - -	637·4	269·0
Five Suburban Districts - - -	514·3	263·4

Local distribution of diarrhœal mortality.

d. The mortality has been unequally distributed in different parts of the district, but the death-rates have not been calculated for small districts, on account of the great difficulty of computing their population in a trustworthy manner. It was found that houses in districts which had been selected for this purpose sometimes contained several families, which of course rendered it impossible to estimate the population with any approach to accuracy. The rate of mortality has, therefore, been only calculated for the several sub-registration districts, the population of each being first estimated on the supposition that it has increased in the same ratio since 1851 as during the ten preceding years. The annexed table shows the mortality per 1,000 persons in each of the urban sub-districts, and in the five suburban districts here treated, as though they formed but a single district:—

Rate of mortality in urban and suburban districts.

Ancoats - - -	2·63
Deansgate - - - -	2·37
London Road - - - -	2·27
Market Street - - -	1·84
St. George's - - -	2·15
Five Suburban Districts - -	0·96

Local conditions affecting the mortality from diarrhœa.

The peculiar arrangement of the privies prevails more or less in every part of Manchester, but is not equally objectionable in all. Some of the older portions of the town, as has been already stated, are less crowded with buildings than the newer parts, land being of less value when they were constructed; and although the houses are frequently loftier than in the modern districts, the interspaces are wider, and the privies in less immediate proximity to the dwellings. Other parts are so densely covered with buildings, that the space between the rears of parallel streets very generally does not exceed 14 or 15 feet, within which are crowded privies and ash-pits, tainting the air with their unwholesome exhalations. The differences of diarrhœal death-rate appear to coincide with these local differences of construction. Ancoats district, which is very densely built, has the highest rate of mortality in proportion to its population. This is the more

* Market Street District contains the workhouse and infirmary.

striking, as the proportion of infant deaths is somewhat less in Ancoats than in the other districts. There is a block of streets in Ancoats, bounded by Oldham Road, Great Ancoats Street, and Union Street, where many deaths from diarrhœa have occurred during the last five years. In Gun Street the mortality has during the same period been at the rate of 4·8 per 1,000 persons per annum. The houses are somewhat overcrowded, and occasionally contain two or more families. The yards are of the smallest size compatible with the local regulations, and the privies, therefore, are in immediate proximity to the houses. The street is narrow, and the back premises are often ill kept, and usually offensive. The evidence of the prevalence of diarrhœa in this street afforded by the Death Register, was confirmed by the information gathered from the inhabitants. The mortality in Henry Street, which is parallel to Gun Street, has also been considerable, but could not be estimated with accuracy. The rate of death was also estimated for other streets, with as close an approximation to the truth as was possible. Thus, in Jersey Street, a better conditioned street in the neighbourhood of Gun and Henry Street, with larger yards, and the privies further from the houses, the average annual rate of mortality has not exceeded 3 per 1,000 persons. This rate appears to be common in the smaller streets of Manchester, inhabited by the working classes; the rates of several, in different parts of the district, which were calculated having varied from 3 to 3·5 per 1,000 persons, and they are only not referred to by name here, because there was difficulty in determining either the population or the number of deaths with precision, there being in most of them courts having access to two streets, under the name of either of which the deaths might be registered. The connection between the mortality from diarrhœa, and the existence of privies in the immediate neighbourhood of dwellings, was repatedly ascertained, and the comparative immunity of places freer from this local nuisance was also apparent, both from the evidence of the inhabitants, and the small number of deaths recorded in the Death Register.

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Gun Street.

Henry Street.

Jersey Street.

CHORLTON comprises Ardwick, Chorlton, and Hulme, which form integral portions of the city of Manchester, besides several less populous townships. Chorlton, like Manchester, was visited by cholera in 1849, but comparatively escaped this disease in 1854. It also participated with Manchester in the visitation of epidemic diarrhœa in 1852, more persons having died of this disease in that year than in 1854. Exclusive of 279 deaths from cholera in 1849, there died of diarrhœal disease in Chorlton, that is to say, of diarrhœa, dysentery, and cholera, 3,269 persons during the eleven years 1848–58, of whom 2,334 died in the septennial period 1848–54, and 1,283 in the five years 1854–8. The average annual number was 332 during the earlier, and 256 during the later period, showing therefore a manifest decrease in the mortality of late years, notwithstanding the increase of population. Chorlton contained 123,841 inhabitants in 1851, and, if

CHORLTON.

Diarrhœal mortality.

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Population and rate of diarrhœal mortality.

Rate of death from all causes.

the population increased after that year at the same rate as during the previous ten years, it would in 1856 consist of nearly 156,000 persons. The decrease in the diarrhœal mortality becomes more evident when reduced to a ratio by the aid of these figures; the diarrhœal death-rate which, exclusive of the deaths from cholera in 1849, had amounted to 2·70 during the septennial period 1848–54, having fallen to 1·65 per 1,000 persons during the five years 1854–8. The decrease in the diarrhœal mortality has therefore been very nearly in the same proportion as in Manchester. The mortality from all causes has also diminished from an annual average of 26·17 per 1,000 persons during the seven years 1848–54, to 23·11 during the five years 1854–8, a decrease rather larger than has taken place in Manchester. Doubtless this improvement in the public health of Chorlton is due, as in Manchester, to the efforts which have been made of late years to promote local cleanliness, and to remove all nuisances likely to be prejudicial to health.

The population of Chorlton increased greatly during the ten years 1841–51, and has probably gone on rapidly increasing since, thus rendering it quite impracticable to estimate the population of smaller districts with any approach to accuracy. It was also observed, in arranging the deaths under the names of the streets in which they occurred, that, although the districts inhabited by the wealthier classes had suffered least, no particular streets had suffered so much more severely than others as to mark them out for special examination. Silver Street, in which more deaths from diarrhœa have occurred during the last five years than in any other street in Chorlton, is a long narrow street, with many cellar dwellings and several courts. It is situated in the densest quarter of Chorlton, and its condition is very similar to that of Henry Street, Gun Street, and several of the worst streets of Manchester. George Street, Moss Lane, and several other streets under which many deaths from diarrhœa have been registered, are of considerable extent; and the number of deaths that have occurred in them is due to their size and larger population, not to their being particularly unhealthy.

Sanitary condition.

Notwithstanding this, the district was thoroughly examined, and the same evils were found to exist in it as in Manchester, but in a minor degree, the ground being less densely covered with buildings, so that, with few exceptions, there is a wider space between the rows of houses. It is true the same regulations relative to new houses apply to Hulme, Ardwick, and Chorlton, as to Manchester; and, in some cases, they have been as closely adhered to; but this is exceptional, and more commonly the air at the back of the houses is less stagnant in Chorlton than in Manchester.

Division into

The deaths from diarrhœa in Chorlton have been unequally distributed as regards—

a, The different years of the period;
b, The different seasons of the year; and
c, The several stages of life.

a. The variations in the number of deaths from year to year are shown in the subjoined list:— DIARRHŒA IN MANCHESTER. Dr. Greenhow's Report. Fluctuations of mortality from year to year.

1848	387
1849*	377
1850	312
1851	258
1852	416
1853	236
1854	348
1855	200
1856	252
1857	321
1858	162

b. Considerably more than half the deaths occurred in the months of August and September, and three-fourths of them in the months of July, August, September, and October. Reckoning the deaths during the five years at 1,000, they would be apportioned among the several months in the following manner:— Mortality in different months.

January	27·3
February	30·3
March	20·6
April	25·7
May	25·0
June	38·6
July	105.5
August	314·6
September	238·8
October	109·2
November	34·2
December	24·2
	1,000·0

c. Considerably more than half the deaths were those of infants under one year of age, and more than four-fifths of them those of children who had not completed their fifth year. If the deaths during the five years had amounted to 1,000, they would have been allotted to the several stages of life as follows: — Mortality at several period of life.

Under 1 year	599·3
From 1 to 5 years	239·4
„ 5 to 60 years	90·1
Over 60 years	71·2
	1,000

Registration District comprehends the borough of Salford, *SALFORD.*

* Exclusive of 279 deaths from cholera.

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Cholera.

Diarrhœal mortality.

Population, and rate of diarrhœal mortality.

Rate of mortality from all causes.

Description.

Sanitary condition.

together with Pendleton, Pendlebury, and Broughton. In common with Manchester and Chorlton, it was visited by cholera in 1849, and almost entirely escaped the visitation of 1854. In the former of these years, 234 deaths were occasioned by the epidemic. It also participated, but less severely in proportion to its population, in the diarrhœal epidemic of 1852. Exclusive of the deaths from cholera in 1849, but including the deaths from cholera, dysentery, and diarrhœa in the other years of the series, 2,748 deaths were caused by diarrhœal disease in Salford during the 11 years 1848–58. Of these, 1,863 occurred during the seven years 1848–54, and 1,239 during the five years 1854–58, being an annual average of 266 during the earlier, and of 248 during the later period. There has thus been a decrease in the diarrhœal mortality of Salford, as well as in that of the adjoining districts. The population of Salford in 1851 consisted of 87,523 persons; and, if it has increased in the same ratio since 1851 as during the preceding ten years, it would consist in 1856 of nearly 98,000 persons. If this estimate be correct, the average annual diarrhœal death-rate, which was 3·03 per 1,000 persons during the septennial period 1848–54, has only been 2·55 during the five years 1854–8. Thus the diminution of mortality, although unquestionable, has been smaller in Salford than in either Manchester or Chorlton. The rate of mortality from all causes has likewise been less during the last five than during the seven preceding years. It was 27·83 per 1000 persons during the seven years 1848–54, and has only been 26·58 during the five years 1854–8.

Some parts of Salford are very densely covered with buildings, but others are much less densely built than Manchester, which in many respects it closely resembles, but with this difference, that the privy nuisance is, in some respects, even worse in Salford than in Manchester. Houses placed back to back, and cellar dwellings, are common in Salford. Houses are not often let in single-room tenements, and are rarely overcrowded, usually containing only the members of a single family. The sanitary arrangements in some of the more recently-built houses are quite satisfactory; those in some of the older streets very much the reverse. There are no waterclosets to the dwellings of the poorer classes; the soil from the privies being removed by the municipal authorities, forms a source of revenue which would be lost if waterclosets were in general use. The water supply is the same as that of Manchester, being exclusively derived from the Manchester Waterworks; wells, formerly in common use, have been altogether disused and covered over. The rule respecting privies is, that they shall be constructed for cottage property to the satisfaction of the Sanitary Committee, and, although sometimes one of these conveniences is allowed to serve for six houses, the Committee generally require that there shall be one for every four houses. In some parts of the town privies are well apart from dwellings; in others they are, as in Manchester, situated in very small yards, and in close proximity to the houses. In very many instances they are either actually within the houses, having dwelling-rooms immediately over them, or in the centre of

rows, having houses on either side; being, in fact, constructed in what were formerly houses, the upper floor being left unoccupied or employed for ventilation. Sometimes, but more rarely, houses have been entirely removed, and privies erected on their site. It would be easy to give examples of these several arrangements; but as regards that which is so common here, the existence of privies in the middle of rows of houses or actually underneath dwellings, it may serve to show the prevalence of the custom to mention that this arrangement was observed in Temperance Street, Arlington Street, Bury Street, Silk Street, and several adjoining places; in Back Hampton Street, in several of the short streets in Green Bank, in Ryland Street, Davies Street, Durham Street, and other small and narrow streets in the same neighbourhood; in Cross Court, Greengate, in Thompson Street, Garden Street, Hope Street, and Canal Street. In several of these places the inhabitants residing in the adjoining houses complained of the privies, and sometimes diarrhœa had prevailed among them.

Local conditions producing diarrhœa.

But the most striking fact illustrating the connection that exists between the prevalence of diarrhœa and the existence of foul privies in the immediate neighbourhood of dwellings, is afforded by the history of four small courts in Regent Street, called Griffith's Buildings. These courts are close, confined, unpaved, and have privies in houses below occupied rooms. The population is small, but the mortality from diarrhœa very considerable. Deaths have occurred from this disease in each of the last five years, and the average annual diarrhœal mortality has been at the rate of 7·2 per 1,000 persons. Allowance must be made for the fact that statistical deductions from small numbers are not entirely trustworthy; but even making a considerable reduction from the death-rate on account of the smallness of the population, the mortality cannot but be considered as excessively high.

Mr. Pickering, the local sanitary inspector, has courteously furnished the number of houses in several well-defined blocks of streets in Salford. By the aid of this return the population of the several districts has been estimated, and the death-rates calculated; but these districts contain some better conditioned places, and the diarrhœal death-rates scarcely differ from that of the whole district. It has been found difficult to determine either the number of the inhabitants or of the deaths with sufficient accuracy in smaller districts, owing to the complicated arrangement of the streets and courts. Among the larger districts just spoken of, the average annual diarrhœal death-rate of a block on the north side of Broughton Road, including Davis, Durham, Ryland, Broster, Barlow, Vale, and Bedford Streets, containing a population of upwards of 2,000 persons, has been slightly under 3 in 1,000; that of a similar well-defined district, between Chapel Street and the river Irwell, containing a population of 2,500 persons, has been 2·5 per 1,000, or very nearly the same as that which prevails in the whole of Salford.

Rate of diarrhœal mortality in particular districts.

The mortality in Salford has been unequally distributed as regards,—

Division into Heads.

a, The different years of the period;
b, The different seasons of the year; and,
c, The several stages of life.

Fluctuations of mortality from year to year.

a. The number of deaths in each of the 11 years is shown in the subjoined list:—

1848	224
1849*	291
1850	192
1851	191
1852	368
1853	243
1854	352
1855	189
1856	203
1857	269
1858	226

Mortality in different months.

b. Half the deaths during the five years occurred in the months of August and September; rather more than two-thirds in the months of July, August, September, and October. Reckoning the deaths during the five years at 1,000, they would be allotted among the several months of the year, in the following proportions:—

January	18·5
February	33·0
March	33·0
April	33·9
May	40·1
June	32·0
July	94·6
August	265·0
September	249·0
October	120·5
November	40·1
December	30·3
	1,000

Mortality at several periods of life.

c. More than half the deaths were those of infants under the age of one year, and more than four-fifths those of children who had not reached the fifth anniversary of their birth. If the entire mortality during the five years had been 1,000, it would be distributed among the several stages of life in the following manner:—

Under 1 year	578·2
From 1 to 5 years	277·4
„ 5 to 60 years	72·2
Over 60 years	72·2
	1,000

* Not including 234 deaths from cholera.

The proportion of infant deaths varied from year to year, being 55·8 per cent. of the entire diarrhœal mortality in 1854, 58·1 in 1855, 49·4 in 1856, 54·9 in 1857, and 59·6 per cent. in 1858.

Outbreak of Diarrhœa in New Bailey Prison.

A remarkable outbreak of diarrhœa, which happened in the New Bailey Prison at Salford a short time previous to the present investigation, was inquired into. This outbreak was exceedingly sudden, more than two-fifths of all the prisoners having been attacked by diarrhœa (sometimes of choleraic type) within a few hours, and more than half within two days of the commencement of the outbreak. It then subsided so rapidly, that only two fresh cases occurred on the fifth day, and none afterwards. Altogether, of 466 prisoners in the gaol at the time, 266 were affected by the epidemic. The prison stands low, and very near to the river Irwell, which was in a more filthy condition than usual at the time of the outbreak. Smells are occasionally perceptible within the prison, especially during the prevalence of particular winds, and are attributed either to the drains, which were, however, reported to be in good condition, or to the river. The prisoners were in unusually good health so late as the day previous to the outbreak. The disease attacked prisoners in all parts of the prison indiscriminately, without reference to situation or exposure to the river, and females as well as males. The cells were visited, and no cause to which the outbreak could be attributed was discovered in them. The disease was said by the governor, and subordinate officers, to have prevailed most among the long-time prisoners; but with this exception showed no tendency to attack any particular class, prisoners in solitary confinement having suffered equally with those in associated confinement, debtors as much as criminals. Mr. Stott, the medical officer, expressed no decided opinion as to the cause of the outbreak, which did not prove fatal in a single instance. No change of diet had been made, and the food was examined by Mr. Stone, lecturer on chemistry at the Manchester School of Medicine, and reported to be perfectly free from any ingredient detrimental to health. No corresponding outbreak occurred in the neighbourhood of the prison, and that within the prison walls was limited to the prisoners; the officers and their families, amounting in all to 53 persons, having entirely escaped. The officers and their families breathed the same atmosphere, and were exposed to the same local conditions as the prisoners, the one point of difference between them being that they drank water drawn from different cisterns. Both cisterns were supplied from the Salford Waterworks; but whilst the water drawn from the cook-house cistern, which was used for the prisoners' food, was said both by the governor and surgeon to have been less bright, of a yellowish colour, and somewhat unpleasant taste, on the day of the outbreak, that from the other cistern used by the officers and their families was bright, clear, and refreshing. On examination it was found that the cook-house cistern communicated with the common sewer by means of an untrapped waste-pipe, allowing free passage of the sewer gases into the cistern; that the cistern was covered over with boards which confined the gases, so as to favour their absorption by the water; and that when a man was sent

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to clean it out, he complained of the existence of an offensive smell in the cistern. Unfortunately the water was run off, and the cistern cleansed, without being scientifically examined; but the fact that the outbreak was confined to the prisoners who alone used this water, that the water was unpleasant, and had a different appearance from that of the other cistern, and that the cook-house cistern had direct communication with the atmosphere of the sewer, appear to justify the governor in his opinion that the outbreak was caused by the use of this water for making the prisoners' gruel.*

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* The following report, from the governor of the prison to the justices, is extracted from the "Manchester Guardian" of October 25th, 1859:—

"On Wednesday morning, the 28th September, at an early hour, several cases of diarrhœa appeared among the prisoners. Mr. Stott, the surgeon, was immediately sent for, and administered such relief as he considered necessary. Before the close of the day, out of 466 prisoners in the gaol, no less than 196 persons of both sexes were attacked, some with symptoms which assumed a choleraic type. On the 29th there were 56 cases, on the 30th, 7; on the 1st instant 5, and on the 2d, 2; total, 266. After the latter date no fresh case occurred. It may, therefore, be said that the serious features of the epidemic continued only about two days. On Friday, the 7th instant, the surgeon reported to me that the prison had resumed its usually good state of health; and I have the satisfaction to add that it has continued so to this date. On the day of the outbreak I examined the water in the cook-house cistern, used for the food, and found it of a yellowish colour, and insipid in taste; I compared it with the water from another cistern in the prison, which was clear and refreshing (both were supplied from the Salford Waterworks). I immediately ordered the water from the cook-house cistern to be run off, for the purpose of its being cleaned out, although that had been done not quite a month ago; in doing which it was for the first time discovered that the overflow pipe, which had been there for many years, had never been trapped, notwithstanding that it communicated directly with one of the main sewers from the gaol to the river, and conveyed a most foul stench to the cistern, which again having been covered in closely with boards, to keep out the dirt, confined the foul gases to the water, and, in my opinion, produced, on the 28th ult., the sudden attack of illness in the prison. It may be urged that if this open pipe from the main sewer, as described, caused the outbreak of diarrhœa in the present instance, why did it not produce similar effects before? I reply that the late summer, which was unusually warm and close, aided the filthy river, which daily became more offensive to the part of the prison near it, to bring to a climax that which, to some extent, may have been operating injuriously to the health of the prisoners for years. In support of my opinion, that the foul state of the water caused the recent illness in the gaol, I take the liberty to point out that at the outbreak there were 53 persons residing on the premises who did not partake of the water from the cook house, not one of whom was attacked; viz. 8 male officers, 7 wives of ditto, 24 the sons, daughters, and children of the resident gaol officers; 11 female officers, 3 female servants; total, 53. On the 29th ult. I sent samples of bread and meal to Mr. Daniel Stone, lecturer on chemistry at the Manchester School of Medicine, with a request that he would analyse them, and report the result for the information of the visiting justices. I herewith append an extract from that gentleman's report:—'I have to report that I submitted the articles to a rigid chemical examination, and the result of every experiment I made was decisive that the bread and the meal contained no ingredient detrimental to health; I am satisfied of the wholesomeness of both articles.' The meat supplied to the gaol has uniformly been excellent; the potatoes good; no question can, therefore, arise as to the wholesomeness of the solid part of the food. The gaol has recently been whitewashed throughout; in short, whitewashing is continuous; the cells and rooms are well ventilated; the bedding is good, and the prisoners are regularly exercised; there can, therefore (humanly speaking), be no reason why a 'virulent epidemic' should attack the inmates of this prison, where every care and attention are paid to health and cleanliness, and yet not visit the narrow streets, and too frequently dirty dwellings, amidst extreme poverty, in the immediate neighbourhood; particularly as it does not appear that this epidemic, like the epidemic of previous years, has shifted from this locality to another."

Diarrhœa in Manchester.

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Summary.

As in Coventry and Nottingham, so in Manchester, the large diarrhœal mortality of children is partly attributed by the medical men to the neglect arising from the employment of women in factories. Infants, it is said, are frequently left by their mothers at the age of three or four weeks for the greater portion of the day, during which they are fed upon bread and water, and more rarely upon arrow-root and milk. Coffee, meat, and "little drops" of gin are also sometimes given to infants; and the system of drugging with Godfrey's Cordial is so common, that one druggist is reputed to sell thirty gallons per week of this narcotic. Mr. Leigh, one of the sub-registrars, and likewise a medical practitioner, who has devoted much attention to the sanitary state of Manchester, attributes the frequency of atrophy in young children to this system of drugging them with opiates, and the large mortality among children from diarrhœa, to neglect; parents, he says, send for medicine to druggists at the commencement of an illness, and only call in medical advice when the case has assumed a serious character. But, it was also stated by some of the medical gentlemen that diarrhœa prevails likewise among persons not of the poorest class, and among adults, to neither of whom the above mentioned causes are applicable.

Diarrhœa from drinking impure water.

With the exception of the outbreak in the Salford Prison, diarrhœa, produced by the drinking of impure water, appears to be unknown in Manchester, the water supply being derived from the Manchester Waterworks, and of good quality. The local distribution of diarrhœal disease has varied less in Manchester than in some of the towns previously visited; but where such variations have been observed, they appear to have been in a direct ratio to the tainting of the air with the exhalations from foul privies or ash-pits. The inhabitants themselves sometimes complained of the effluvia, and also, in a few instances, attributed the prevalence of diarrhœa among their households to this cause. In all probability the general diffusion of deaths from diarrhœa in Manchester should be referred to the uniform manner in which stinking ash-pits and privies are distributed throughout the town; and the slightly higher mortality of Salford to the larger proportion of privies in common use by the inmates of several houses, causing the accumulation of ordure in larger quantities in the midst of the population, and to the closer proximity of this nuisance, in but too many instances, to the dwellings.

Local conditions producing diarrhœa.

CONCLUDING SUMMARY.

Concluding Summary.

Although the primary object of the present inquiry has been to ascertain the local distribution of diarrhœal disease in the several districts, and to investigate the extent to which the prevalence of this disease in each place is connected with the sanitary circumstances of the population, yet there are other circumstances, as the influence of season and period of life, which could not be disregarded without impairing the completeness of the investigation. These circumstances being of a more general kind, and not limited to any particular locality, have been but

Diarrhœal Districts.

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imperfectly referred to in the preceding pages, and therefore now require a further brief consideration. They are three in number, viz.:—

1, The influence of epidemic epochs;
2, The influence of season; and
3, The influence of age.

Influence of epidemic epochs.

1. The influence of epidemic epochs has been most marked, and the years in which diarrhœa has occurred in an epidemic form have been nearly the same in all the districts, but the intensity has varied in the several places. If cholera be taken into account, 1849 was the most fatal year in all the places, except Birmingham and Nottingham, in the former of which 1854, and in the latter 1857, was the most fatal year. In Coventry 1851, and in Manchester, Chorlton, and Salford, 1852 were, next to 1849, the most fatal years. With these exceptions, and that of Birmingham, where it stands highest in the order of mortality, 1854 was, next to 1849, the highest in the order of mortality. Independently of slighter fluctuations, there have, therefore, been four well-marked epidemic periods during the eleven years 1848–58, namely, the year 1849, when cholera and diarrhœa prevailed very extensively throughout England; 1852, when cholera did not prevail, but in which a severe epidemic of diarrhœa prevailed in Birmingham, Wolverhampton, Leeds, Manchester, Chorlton, and Salford;* 1854, when cholera again prevailed less extensively than it had done in 1849, but still with great severity in certain parts of England; and 1857, when cholera was not epidemic in this country, but diarrhœa prevailed very extensively. The following table shows the number of deaths in each year, and in each district:—

Table showing the number of deaths from diarrhœa in each place and year.

District.	1848.	1849.	1850.	1851.	1852.	1853.	1854.	1855.	1856.	1857.	1858.
Coventry - -	78	103*a*	64	187	162	116	176	60	77	158	61
Birmingham - -	440	464	444	480	511	392	610	308	358	609	352
Wolverhampton -	122	251*b*	130	190	272	194	372	133	199	285	151
Dudley - -	240	270*c*	174	250	262	214	358*d*	187	208	348	208
Merthyr Tydfil -	51	96*e*	75	125	124	117	137*f*	93	65	114	78
Nottingham - -	58	125	92	140	128	129	179	66	92	221	169
Leeds - - -	243	304*g*	204	294	386	270	283	148	184	258	251
Manchester - -	644	900*h*	678	494	937	543	728	449	492	695	472
Chorlton - -	387	377*i*	312	258	416	236	348	200	252	321	162
Salford - -	224	291*k*	192	191	368	243	352	189	203	269	226
Total † - -	2,487	3,211	2,365	2,609	3,566	2,454	3,543	1,833	2,130	3,278	2,130

a. Exclusive of 202 deaths from cholera.
b. Exclusive of 1,364 deaths from cholera.
c. Exclusive of 412 deaths from cholera.
d. Exclusive of 256 deaths from cholera.
e. Exclusive of 1,683 deaths from cholera.
f. Exclusive of 455 deaths from cholera.
g. Exclusive of 1,436 deaths from cholera.
h. Exclusive of 890 deaths from cholera.
i. Exclusive of 279 deaths from cholera.
k. Exclusive of 234 deaths from cholera.

† Besides which there have been from epidemic cholera, in 1849, 6,500 deaths; and in 1854, 711 deaths.

* Diarrhœa prevailed in an epidemic form very extensively in England in this year. It produced a very decided increase of mortality in Blackburn, Rochdale, Knaresborough, Derby, Wigan, Ulverstone, Sculcoates, Preston, Ecclesall, Bilston, Huddersfield, Halifax, Bradford, Liverpool, West Derby, Macclesfield, Bedford, Luton, Norwich, Penzance, and Redruth.

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In all probability the fluctuations in the mortality from year to year have been largely caused by peculiarities of atmospherical condition, but no data are before me which would enable me to show the meteorological conditions under which diarrhœa has become epidemic.

The influence of season.

2. The later summer months, and the earlier months of autumn, have everywhere been those in which the largest proportion of deaths has occurred. Excepting in Dudley and Merthyr Tydfil, about two-thirds of the deaths in each district during the five years 1854–8 happened in the months of August, September, and October. The mortality in Merthyr Tydfil has been much more equally distributed throughout the year; and July, which in other places has stood high in the scale of mortality, has here been the least fatal month. Dudley has exhibited, but in a less marked degree, a similar equability in the distribution of deaths from diarrhœa throughout the year as Merthyr Tidfil.

August has been the most fatal month in Manchester, Chorlton, and Salford; September in the other districts. These differences may perhaps be attributed to local peculiarities of climate. The subjoined table shows the proportion per 1,000 deaths which have occurred during each month of the year, and in each place in the course of the five years 1854–8:—

Table showing the proportion of deaths in each month of the year for

District.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
Coventry -	29·4	32·9	31·3	43·3	29·4	39·9	79·7	227·1	263·4	157·7	38·2	27·7
Birmingham -	30·4	26·1	34·3	23·2	34·7	27·0	72·0	220·0	313·0	154·0	40·3	25·0
Wolverhampton	36·8	31·8	28·5	26·8	34·5	38·5	53·6	177·7	304·3	168·5	65·5	33·5
Dudley - -	46·7	39·5	50·3	45·2	46·7	54·0	40·9	130·7	224·1	183·2	85·5	53·2
Merthyr Tydfil	62·9	62·9	73·0	90·7	62·9	62·9	25·4	98·3	143·8	138·5	105·9	52·8
Nottingham -	20·4	22·0	27·0	25·8	10·9	36·7	97·9	272·1	272·2	131·9	58·5	24·4
Leeds - -	21·7	27·2	21·7	22·6	31·6	38·8	101·4	273·0	282·0	118·4	33·4	23·2
Manchester -	20·2	19·7	25·2	20·9	32·2	42·2	146·5	321·9	221·8	99·0	31·0	19·4
Chorlton -	27·8	30·3	26·6	25·7	25·0	38·6	105·5	314·6	238·8	109·2	34·2	24·2
Salford - -	28·5	33·0	33·0	33·9	40·1	32·0	94·6	265·0	249·0	120·5	40·1	30·3

The influence of age.

3. A very large number of the deaths were those of young children, but the proportion has varied in different places. With the exception of Merthyr Tydfil and Dudley, more than half the deaths were those of infants in the first year after birth. The deaths of infants have borne the largest proportion to those of all ages in the three manufacturing towns, Coventry, Nottingham, and Manchester, in each of which evidence has been adduced of the mismanagement of infants, arising from the employment of mothers in factory labour. The different proportions in each place would seem to countenance the opinion that the assigned cause is not without influence, seeing that a much larger proportion of the women of Coventry were employed in the special manufactures of that city in 1851 than of those of either Manchester or Nottingham. The four years between the completion of the first and the termination of the fifth year after birth is the next most fatal period of life, and the deaths

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in these four years being added to those of the first year, very nearly equalize the mortality in most of the places during the first five years of life. But here again variations exist, which would appear to denote the operation of different influences in the several districts. Manchester and Salford have been the districts most fatal to children; next to them Coventry; whilst in Leeds, Merthyr Tydfil, and Nottingham, the proportion of deaths of children under five years of age from diarrhœa, in proportion to the whole mortality from this disease, has been smaller than in the other places. The following table, based upon the assumption that 1,000 deaths have occurred in each district, shows at a glance the proportion which the deaths from diarrhœal disease at each period of life bears to the total mortality from this disease in the several places. The figures have already been given separately for each place, but they are here placed side by side for all the places, and an additional column has been added to show the mortality under five years of age:—

Table showing the proportion of deaths at each period of life in each district.

Name of District.	Under 1 Year.	From to Years.	Under 5 Years.	From 5 to 60 Years.	Over 60 Years.	All Ages.
Coventry	675·9	176·8	852·7	69·3	78·0	1·000
Birmingham	549·0	267·0	816·0	87·0	97·0	1·000
Wolverhampton	522·2	310·1	832·3	94·0	73·7	1·000
Dudley	477·3	359·8	837·1	89·4	73·5	1·000
Merthyr Tydfil	385·4	370·3	755·7	128·5	115·8	1·000
Nottingham	608·0	136·0	744·0	105·0	151.0	1·000
Leeds	535·5	250·5	786·0	92·0	122·0	1·000
Manchester	603·1	273·6	876·7	65·7	57·6	1·000
Chorlton	599·3	239·4	838·7	90·1	71·2	1·000
Salford	578·8	277·4	856·2	72·2	72·2	1·000

The proportion of infant deaths in each place varied in the several years, but there has been no uniformity in this respect in the different districts; even such as are contiguous, like Manchester, Chorlton, or Salford, or near to each other, like Birmingham, Wolverhampton, and Dudley, having differed from one another.

Local causes producing diarrhœa.

However great the influence of season, of age, or of the mismanagement of young children in causing a large mortality from diarrhœa, the concurrence at least of some other cause might be expected from the very different rate of mortality which prevails in different districts. The present inquiry has very clearly established the existence of two principal local causes of this disease. These are the breathing an atmosphere tainted with the products of animal decomposition, more especially, although perhaps not exclusively, that of human excrement, and the drinking of impure water. It is true these causes were previously known to produce diarrhœa, but their investigation had hitherto been limited to epidemic epochs, and especially to visitations of cholera. It is now certain that their influence is more constant, and perhaps the occurrence of epidemic epochs may arise from peculiarities of season giving greater efficacy to these local causes, or possibly to the products of decomposition at such periods being different from those at ordinary times. The latter of the two above named causes, as

plainly appears from the history of certain parts of Coventry, is the most powerful, but the former is the more frequent, and therefore the most influential in augmenting the diarrhœal mortality of towns. Wherever a well-marked local excess of diarrhœal mortality was found, it always occurred in connection with one or other of these two circumstances; and generally, as nearly as could be estimated, in exact proportion to the prevalence of the supposed cause.

Confirmation of the opinion here expressed, that the diarrhœal mortality of towns is mainly due to the accumulation of night-soil within their precincts, is afforded by the beneficial results accruing from such local exertions as have had for their object the suppression or diminution of this evil, and which have been attended by success, almost in exact proportion to the greater or less completeness with which this object has been attained.

Manchester, Coventry, and Leeds, afford illustrations of this, the rate of diarrhœal mortality in each of these towns having decidedly fallen concurrently with the introduction of better arrangements for the removal of refuse. But even yet there exist in each of these towns striking sanitary defects, the removal of which would almost certainly be attended by a diminution of the still excessive diarrhœal mortality. The facts in the following table have already been mentioned separately for each district; but it seemed desirable here, in illustration of this subject, to place the rate of mortality of the several districts side by side for comparison with one another.

Table showing the rate of death from diarrhœa in each district, and in several sub-districts, for two several periods of seven and five years.

Name of District.	Annual Average Number of Deaths from Diarrhœa per 1,000 Persons.	
	During the 7 Years 1848–54.	During the 5 Years 1854–8.
Coventry	3·50	2·66
Birmingham	2·74	2·33
Wolverhampton	2·10	1·93
Seisdon Union	No data	0·73
Town of Wolverhampton	No data	2·44
Bilston	No data	1·81
Willenhall	No data	1·79
Dudley	2·37	2·21
Dudley Parish	No data	2·74
Tipton	No data	2·44
Merthyr Tydfil	1·35	1·06
Lower Merthyr Tydfil	No data	1·25
Upper Merthyr Tydfil	No data	1·54
Aberdare	No data	0·30
Nottingham	2·08	2·34
Leeds	2·91	2·17
Manchester	3·20	2·28
Chorlton	2·70	1·65
Salford	3·03	2·55

The results of my investigation may be summed up in the following conclusions :—

1. There has been a considerable permanent annual mortality from diarrhœal disease in each of the districts, but the deaths have been most numerous in certain years, which have, with few exceptions, agreed in the several places.

2. The larger proportion of the deaths has occurred in the months of August, September, and October. This proportion has amounted to two-thirds in all the districts, excepting Merthyr Tydfil and Dudley.

3. A very large proportion of the deaths have been those of children below the age of five years. This proportion has amounted to four-fifths of the deaths from diarrhœa in all the districts excepting Nottingham and Merthyr Tydfil, in each of which it has formed about three-fourths of the mortality.

4. The excess of mortality has in all the places been coincident with one or other of two definite local circumstances.

a, The tainting of the atmosphere with the products of organic decomposition, especially of human excrement.

b, The habitual drinking of impure water.

5. The former of these causes is the more prevalent; and the mortality has, with few exceptions, been very nearly in exact proportion to the intensity thereof, having been largest where foul privies existed in juxta-position with houses, or where their exhalations were so confined by walls or buildings, as to retard their dispersion into the general atmosphere.

6. The mismanagement of children is certainly an aggravating cause of diarrhœa in manufacturing towns, but its influence could not be accurately estimated. The effect of this cause appears to be chiefly exerted during the first year of life.

VII.

Proceedings in reference to the prevalent Epidemics of Diphtheria.

During the last four or five years there have been prevailing in various parts of England alarming epidemics of DIPHTHERIA,—a disease which, as epidemic, was previously almost unknown to the present generation of medical practitioners. Not quite unknown, indeed; for, although the last great prevalence of the disease in Britain was during the two middle quarters of last century, there had been since that period, and within living recollection, a few little local epidemics, as well as some isolated cases. But, from the summer of 1855 to the present time, diphtheria has again been continuously prevalent in England; invading different places in succession; sometimes remaining fixed (even for three and four years) where once its footing has been gained; sometimes holding less tenaciously to the place, and leaving it after only some few weeks' tenure; but unfortunately also sometimes returning to it again and again.

These facts have been made known to the Privy Council; and, in consequence, during the past year, extensive inquiries have been made, under orders of the Privy Council, with a view to collect for common use the various particulars of experience which different localities could supply. Much correspondence has taken place with this object; and the principal seats of the epidemic (to the number of 70, situate in 17 different counties of England) have, during the year, been personally visited for the purposes of more minute inquiry. The valuable information thus collected is given in the following papers.

Had time allowed, it might have been desirable to bring the mass of material into a somewhat different arrangement. But even the present primary compilation has but quite recently been completed; and though the utmost despatch has been used, it has been found barely possible to include the information, as it now stands, in the present Annual Report. On the whole, however, it has seemed far better to take this course, than to let a year elapse before the publication of matter which may be of much professional use. All the more, too, this course has seemed eligible, because the present papers represent only in part the facts of a visitation which unfortunately is still in progress. And before the history of the present epidemic can be adequately written, much other information has to be collected.

Diphtheria.

To illustrate the great difficulties which in this country attend any attempt to investigate scientifically the facts of epidemic disease, it deserves consideration that no periodical returns are here made with respect to disease treated at the public expense; nor is any local authority bound (however needfully for the public good) to give information to the Government as to the outbreaking of any unusual epidemic. Diphtheria had been prevalent in parts of England for two years* before there was any public knowledge of the fact; and under these circumstances, it has been scarcely possible to procure any trustworthy record of the

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* Diphtheria began to be prevalent in Cornwall in the autumn of 1855. It was not till November 1857 that the then existing General Board of Health had such information as justified its issuing any public notification on the subject. In the number of the 'Weekly Return of Disease in the Metropolis,' printed by the Board with reference to the week ending Saturday, October 31st, 1857, there was contained the following passage:—

"In future numbers of the 'Weekly Return' a separate column will be allotted to new cases of *diphthérite**;—a peculiar, very dangerous, febrile disease, attended with destructive inflammation in the mucous membrane of the throat, and specially marked by the formation there of an *adhesive or croupy false membrane* which conceals the inflamed surface, and belongs (not, as in true croup, to the respiratory passages, but) especially to the pharynx and fauces. This disease has no popular English name; for, though it has been well known and well described in France, it has hitherto in England been comparatively unknown as an idiopathic complaint.

"At the present time diphthérite threatens to demand more attention in this country; for apparently it is to its prevalence, as a cause of death in several districts, that various registrars' notes in the late quarterly report of the Registrar-General refer. In these notes 'inflammation of the throat,' 'putrid sore throat,' 'malignant sore throat,' 'disease in the throat,' and 'throat-fever,' are the expressions used to designate a complaint which has proved fatal in the registration districts of Thame, Billericay, Maldon, Liskeard, Truro, and Chesterfield; and other information makes it probable that an unusual disease of the throat is prevailing more or less epidemically in some other parts of the country. There is reason to believe that cases are also occurring within the limits of the metropolis; sometimes recognised in their true nature, and called either diphthérite or Boulogne fever; sometimes, perhaps, mistaken for true croup, or for the throat-inflammation of scarlet fever, or for some other disease. Cases of this unfamiliar complaint will be interesting to the officers of health; who, with a view to the prevention of the disease, will of course be anxious to collect information both as to its predisposing and exciting causes, and as to the symptoms which betoken its commencement. It is therefore important that the many names under which it may appear in the registers of sickness and mortality should be borne in mind."

"* Diphthérite is a word which, according to its etymology (διφθέρα, a hide or membrane) has been applied to many diseases in which the presence of a croupy exudation is a remarkable feature; but in England it is commonly received in the limited sense of diphtheritic (*i.e.* false-membrane-forming) inflammation of the pharynx."

first beginnings of the disease. Even as regards a less exact kind of observation, the Registrar-General has not had it in his power to supply, for the use of the Privy Council, such an account of the deaths from throat-diseases during successive quarters of the last few years as might have enabled the course of the epidemic and the distribution of its mortality in different districts to be at least approximately mapped out. And the information now submitted, as the fruit of inquiries made by the Privy Council, relates (as already stated) to only parts of the visitation.

With a view to render the following papers as convenient as they can be for reference, there is prefixed to them the Minute which the Privy Council issued (for the use of its inspectors and of other local inquirers) as to the matters which ought particularly to be investigated. And this Minute will serve as the best table of contents to the various papers which succeed it.

HEADS for LOCAL INQUIRY in DISTRICTS where DIPHTHERIA has been EPIDEMIC.

1. *As regards the General Features of the District.*

a. What is the character of the district as to level, exposure, soil, drainage, and (if rural) cultivation, or (if urban) density of building?

b. What is the sonrce, and what the general character of the water-supply of the district?

c. Is the district liable to ague, to autumnal fever or diarrhœa, to bronchocele, or to any other endemic disease?

2. *As regards the Duration, Extent, and Novelty of the Epidemic in the District.*

a. When was the first, and when the last, case of diphtheria in the district?

b. What was the number of attacks of diphtheria, what the number of deaths occasioned by it, and what the number of houses among which the attacks were distributed?

§ Append any lists which individual practitioners will furnish, according to the accompanying form, of the cases which they respectively have attended.

c. Is there any local recollection of diphtheria having prevailed before in the district or neighbourhood? if so, when? and to what extent?

3. *As regards contemporaneous or recent Diseases in the District.*

a. Did other varieties of sore-throat (*i.e.* varieties not attended by the formation of false membrane) prevail in the district at about the same time as diphtheria? If so, did they precede or accompany, or follow, its prevalence? And did they in any cases prove fatal, or present unusual features?

b. Did scarlatina prevail in the district at about the same time as diphtheria? If so, did it precede, accompany, or follow? And did it present unusual features?

c. Did erysipelas or puerperal fever?

d. Did common continued fever?

e. Did any other disease, either of the human subject or of the lower animals, prevail in the district to an unusual extent, or with unusual features, either during, or shortly before, or shortly after, the prevalence of diphtheria?

4. *As regards Local and Personal Conditions predisposing to Diphtheria.*

a. In what number and with what severity, did cases occur in dry and airy parts of the district, as compared with low-lying, damp, and confined parts?

b. In what number, and with what severity, did cases occur in thoroughly well-constructed and well-kept houses or rooms, as compared with houses or rooms in which the atmosphere was offensive from defects of drainage, or from overcrowding and non-ventilation, or from other kinds of uncleanliness?

c. Had the houses in which diphtheria was prevalent been previously much subject to any [and, if any, what?] other kinds of disease?

d. In what number, and with what severity, did cases occur among persons enjoying affluent or comfortable circumstances of life, as compared with persons suffering privation?

e. What has been observed as to the influence of age, occupation, habit of body, and personal antecedents, in increasing or diminishing the liability to contract diphtheria, or to suffer any of its symptoms in a severe form?

Was any difference in this respect observed between persons who had, and persons who had not, previously had scarlatina?

5. *As regards the Communicability of Diphtheria.*

a. Did it often happen [and if so, give instances] that cases of diphtheria occurred singly in households where there were children in free communication with the patient?

b. Did it often happen [and if so, give instances] that all or nearly all the inmates, or all or nearly all the children, of considerable households were eventually attacked with diphtheria, in houses where one case had arisen? or that they were attacked with any other kind of sore throat?

c. Where two or more cases occurred in succession in one house, what commonly was the interval between them?

d. To what extent is it the case (either as regards the district generally, or as regards particular houses and establishments in the district) that the persons first attacked with diphtheria had previously been in communication with houses wherein that disease was prevailing?

or with houses in which some other kind of sore-throat was prevailing? or with houses in which scarlatina was prevailing? or with houses in which erysipelas, or any other kind of febrile or inflammatory disease was prevailing?

If in any case diphtheria seems to have resulted from such communication, what was the nature of the communication? And what time elapsed after the communication before the new case of diphtheria commenced?

Did it ever appear that diphtheria was propagated by accidental inoculation or contact with the morbid secretion of the throat?

If, among persons equally communicating with the sick, some were attacked with diphtheria, while others remained free from it to what was this difference attributed?

6. *As regards the Symptoms of Diphtheria.*

Did diphtheria, as observed in the district, differ in any [and, if any, what?] important respect, from the account given of it generally, in the following paragraphs; viz.:—

a. that the essential local sign of the disease, seen on inspecting the throat of a patient in the early stages of diphtheria, is the presence of a fibrinous exudation, more or less firmly coagulated upon the inflamed surface of the fauces, tonsils, and pharynx; where, blended with the epithelium of the part, widening as the inflammation extends, and becoming thicker by successive additions to its deep surface, it appears as a continuous raised layer of white or whitish membrane (*diphthera*) and tends after some days to be thrown off, like a slough, in a partially decomposed state?

b. that the diphtheritic inflammation is never primarily attended by any ulceration or sloughing of the mucous membrane, though in some cases these processes occur at later stages of the disease; but that always at first there lies beneath the false membrane a merely excoriated surface; on which, while in this state, there may coagulate, before healthy epithelium is restored, successive new layers of fibrinous matter more or less mixed with the corpuscular products of inflammation?

c. that the diphtheritic inflammation, besides generally extending to the mucous membrane of the nose (where also, though rarely, it may begin, and where in either case its presence may occasion epistaxis) sometimes descends along the mucous membrane of the air-passages; superadding, in such cases, the ordinary symptoms and dangers of croup to those of the original affection?

d. that usually the lymphatic glands below the jaw, and sometimes the cellular membrane of the neck, are more or less irritated and swollen during the inflammation of the throat?

e. that the disease is not, except sometimes at its beginning, attended by febrile excitement; but is commonly, throughout its course, marked by signs (often by alarming signs) of depression?

f. that more or less irritation of the kidneys is of very freqnent, if not universal, occurrence at some period or other of the disease; involving, while it lasts, an albuminous state of the urine, and the presence in it of microscopical casts of the urinary tubules?

g. that the disease may be complicated with other internal inflammations—especially with pneumonia; and that intestinal hæmorrhage may occur during its course?

h. that patients often remain in a state of anæmia and weakness, even of dangerous weakness, long after the throat-affection has ceased; and that some of them, during this condition, suffer functional nervous disorder—such as impairment of vision, partial loss of sensation, or paralytic or convulsive affection of voluntary muscles?

§ Append any notes which individual practitioners will furnish, of carefully observed cases of diphtheria, wherein either its less frequent symptoms or complications have occurred, or its common symptoms have been minutely investigated, *e.g.*,

of cases, if any, where cutaneous eruption has appeared—the exact character of which should be specified, as also the period of the disease during which it was visible, and the issue of the cases in which it was observed;

of cases, if any, in which the skin has desquamated;

of cases in which the throat-affection has been accompanied or followed by serious inflammation of internal organs, or by any kind of hæmorrhage;

of cases, if any, in which dropsy has ensued;

of cases in which peculiar nervous sequelæ have been well marked;

of cases, if any, in which a blistered or otherwise excoriated surface of the patient's skin, or the mucous membrane of the pudenda, has taken on anything like diphtheritic inflammation;

of cases in which the urine has been specially examined day by day during the disease;

of cases in which the temperature of the body has been noted;

also of any carefully made post-mortem examination, especially such as may illustrate the internal complications of the disease;

also of any precise observations which may show the value of particular symptoms as guides to favourable or unfavourable prognosis.

7. *As regards the Treatment of Diphtheria.*

a. Has any treatment been found more effectual than the use of ordinary escharotics (*e.g.*, nitrate of silver or hydrochloric acid) to arrest the formation of false membrane in the throat? if any cases were treated without escharotic or stimulant applications, what was the result?

b. Has any treatment been found more effectual than the use

of alcoholic stimulants to counteract the depression which belongs to severe cases of the disease?

Instructions for local inquiries.

c. If tracheotomy has in any case been performed for the relief of laryngeal obstruction arising in the disease, what has been the number and what the result of such cases? Has any treatment been, under the circumstances, more successful than tracheotomy?

d. What treatment has been adopted, and what result has ensued, in cases of internal inflammation complicating the disease?

e. Has any treatment been found more effectual than the use of ordinary tonics to remove the sequelæ of the disease, especially those that affect the nervous system?

f. What knowledge has been obtained as to the fact of any particular drug exerting a specific influence against the disease?

Privy Council Office, London, S.W
1859.

Diphtheria in Essex, Suffolk, Derbyshire, Gloucestershire, Hampshire, Lincolnshire, Warwickshire, Worcestershire, Staffordshire, Cheshire, and Norfolk.

Information collected by Dr. Greenhow.

Information collected by Dr. Greenhow.

I.—Description of District; Water-supply; Endemic Diseases.

ESSEX: Brentwood.—Rather high for Essex clay soil; ague common.

Tolleshunt D'Arcy.—Flat; exposed to north-east winds; clay soil; partly well drained. Water of bad quality, is chiefly taken from stagnant ponds. Ague is the prevalent endemic disease. Bronchocele is unknown.

Maldon.—The town stands partly on an eminence; partly on low ground; rest of the district very low, marshy, and intersected with ditches; soil in and around Maldon, gravel. Diphtheria first appeared in the low-lying portion of the town, but subsequently crept into the higher district. The water is of good quality, hard but pure, and is obtained from springs and artesian wells. Ague is common; fever and diarrhœa are rare.

Southminster.—Low-lying, marshy. Drainage now in progress; well cultivated. The water is taken from springs and wells. Ague is common; diarrhœa rare.

Witham.—Moderately hilly, soil gravel, well cultivated. The water supply is from wells, of good quality, but probably sometimes contaminated by percolation from cesspools. No prevalent endemic disease.

SUFFOLK: Sudbury.—Bulmer and Foxearth, the parishes in which diphtheria occurred, although in the Sudbury Registration District, are really in the county of Essex. Bulmer, two miles from Sudbury, is elevated; the situation is dry; the soil partly light, partly clay, is well drained. Foxearth is three and a half miles from Sudbury in a different direction to Bulmer. Diphtheria was here limited to a single isolated farm-house, surrounded by a moat. Soil dry and gravelly; well drained. Water is obtained from wells; is rather hard, but good and pure. Diarrhœa is rather common; there is no ague.

Lowestoft.—Partly low; partly elevated. Not densely built. The lower and newer portion of the town is but little raised above the sea-level. Gisleham, a small parish between four and five miles from Lowestoft, is neither low nor high; a little damp, but not marshy. Seven other parishes comprised in the same medical district as Gisleham entirely escaped diphtheria. There is very little ague, autumnal fever, or diarrhœa in Lowestoft. No ague in Gisleham during at least the last seven years; fever rare.

DERBYSHIRE: Belper.—Consists of sheltered valleys and hill-sides sloping down to the river Derwent; soil clayey, and naturally well drained. Very little artificial drainage. Population scattered over a wide extent of country. Water said to be of bad quality. Bronchocele, diarrhœa, and fever are common.

Wirksworth.—Town situated in a valley; surrounding country very hilly; town closely built and densely inhabited. Diphtheria has occurred both in the town and in the more elevated portions of the district, but has not been particularly prevalent in the town. The millstone grit is at the surface on the north-eastern part of Wirksworth; carboniferous limestone on the opposite side. The water supply of the town is from springs, of good quality, off the millstone grit. Diarrhœa is prevalent; fever is common in some of the outlying places; bronchocele rare in the town; is common in the surrounding country.

Derby is situated on low flat land; is in general not a densely built town, but contains some densely built courts, the houses in which are back to back with one another, and sometimes overcrowded. The water supply is chiefly from a public company, and is said to be of good quality; sometimes from wells, which are occasionally thought to be contaminated with putrescent organic matters. Typhoid fever is common; diarrhœa not very common; there is no ague.

GLOUCESTERSHIRE: Dursley.—Country hilly; part of the district low, part elevated. Diphtheria has prevailed chiefly in the village of Cam, about a mile from Dursley, which is not densely built, is on a slope, and therefore partly elevated, partly low. Cases occurred in some low-lying houses, but also in more elevated places. The land is in good cultivation, and well drained. The town of Dursley is very badly drained, and by gutters only, but is not densely built. The water is of good quality from wells, but is said to be sometimes vitiated with

organic impurity. This was eminently the case with one public spring at Cam; but the use of the occasionally impure water did not appear to have the slightest influence over either the amount or the intensity of the disease. Typhus has sometimes prevailed at Cam where diphtheria has chiefly prevailed; cholera also prevailed there in 1854. There is a little bronchocele; diarrhœa is rare.

HAMPSHIRE: Christchurch is, for medical relief, divided into two districts by the river Avon. The western district is intersected by the river Stour, which unites with the Avon a little below the town of Christchurch. The country is low and flat near the margin of the rivers, but becomes undulating and in some places comparatively high at a little distance from them. Diphtheria was almost entirely limited to the western side of the Stour, which winds much in its course, and together with some adjacent ditches is much encumbered with weeds, which at the season of their decay are said to produce an offensive smell, and even to taint the water. The disease has chiefly prevailed in the hamlets of Throop, Holdenhurst, and Muscliff, which are near the river. Throop and Holdenhurst are at a low level, and damp; Muscliff is more elevated. The principal population is by the river side, and the soil is there well cultivated, as are likewise some portions of the uplands. Cases occurred at Bournemouth, which is dry, elevated, and not densely built; also at Redhill, a dry, elevated, scattered hamlet at some distance from the river; at Charminster, a dry hamlet of isolated cottages on the side of a hill; and at Strowden, a house in a comparatively elevated and dry situation. The soil of Christchurch is for the most part dry, and either sandy or gravelly. The cultivated portion is well drained, but there is much moorland and some plantation in the district. Diphtheria has prevailed quite as much in proportion to the population in the higher as in the lower ground; on the wilder as on the more cultivated soil. The water supply is chiefly from wells, of good quality, but sometimes tastes of peat. The water supply of Throop is from the river; that of Bournemouth partly from tanks. Ague prevails much in some parts of the district; there is not much fever; diarrhœa is sometimes prevalent, and there is a good deal of bronchocele. The medical officer who attends the paupers of the western district, where diphtheria has almost exclusively occurred, says ague has been commoner lately than for some years previously.

LINCOLNSHIRE: Spalding stands upon a vast alluvial flat on the banks of the river Welland. The surrounding country consists of richly cultivated fens, corn being the staple production. The surrounding fens are well drained by means of steam power, but there remain bits of marsh land in several directions. The town is not densely built. Pinchbeck, a village about two miles from Spalding, and where also there has been a great deal of diphtheria, is low and flat, the soil being a rich clay, highly cultivated. It is still marshy, but much has been done in the way of

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drainage. Moulton, where diphtheria has also prevailed, is a very low and marshy parish nearly midway between Spalding and Holbeach. Spalding derives its water supply chiefly from the Welland, and also from stagnant ponds and ditches. The water is said to be brackish. The water at Pinchbeck is hard, but of good quality. At Moulton it is taken from ditches, and is said to be good. Ague is common in all these places. It had been less common than formerly, but was unusually prevalent in the year 1858, when typhoid fever was also prevalent. Diarrhœa occurs in the autumn at Spalding, but cannot be said to prevail. Neuralgia and remittent fever, as well as ague, are very common at Moulton, where continued fever is alleged to be rare. Ague was unusually common in the years 1857 and 1858. Diarrhœa is also a common disease at Moulton.

Horncastle is elevated, being 88 feet above the Witham at Tattershall; soil dry and gravelly. The water from wells is of good quality, but hard. In general there is not much ague, but there has been more within the last 15 months than for 40 years previously. Typhus is rather common in some of the surrounding villages. Diarrhœa is rare.

Coningsby.—Low, fenny, but well drained; soil well cultivated. The water is of good quality. Ague is common, and was unusually so in the year 1858. Continued fever is rare. Diarrhœa is usually prevalent in autumn, but was rare in the autumn of 1858.

WARWICKSHIRE: Birmingham is elevated and dry; soil sandy or gravelly. The town is partially drained, and not densely built. The same description applies to Edgbaston. Diphtheria has also prevailed at Spark-brook, Highgate, Moseley, Erdington, Water Orton, and Sutton Coldfield, places in the vicinity of Birmingham. Spark-brook is a flat district; soil clay; drainage imperfect. Highgate, about two miles distant from Birmingham, from which it is separated by the valley of the river Rea, lies partly upon a slope, partly in the valley; soil clay. Moseley is about a mile south from Highgate, and is rather more elevated; soil sandy. Erdington is high, the land upon which the village stands sloping gradually upwards from the river Tame, which was very offensive about this part from the sulliage of Birmingham. Cases of diphtheria occurred at Bromford by the river side, but the disease was not confined to the margin of the river, aud also prevailed on the hill side and in the village, too distant from the river to be influenced by its foul condition. On the north-west of Erdington is a large reservoir, which at the time of the outbreak of diphtheria was a mere expanse of wet mud, the water having been temporarily run off. The soil is sand and gravel. Natural drainage excellent. No dense building. Cases occurred at Witton Pool in cottages built upon a drained swamp. Water Orton is elevated. The cases here occurred in isolated houses of a good class at some distance from the river. Sutton Coldfield stands high; the drainage is good; the buildings are

not dense. The soil is sand and gravel. The water supply of Birmingham is chiefly derived from the waterworks, but also partly from wells, the water of which is sometimes contaminated by the percolation of sulliage. The medical men represent the water from the reservoir as impure, and containing a very large amount of organic matter. The water supply of Edgbaston is similar to that of Birmingham; that of Highgate is entirely from wells, good, free from organic impurity, but very hard and calcareous. That of Moseley is softer, pure, but less pleasant. That of Erdington is from pumps, pure, but scanty. That of Sutton Coldfield is also from wells, abundant, pure, and of good quality. Ague is unknown. Bronchocele is common in some of the districts around Birmingham. There is always a marked amount of typhoid fever and of diarrhœa in autumn. Rheumatism is very common. Typhoid fever is also common in Edgbaston, where diarrhœa is said to prevail less than in Birmingham. Endemic disease is said to be almost unknown in Sparkbrook, Highgate, and Moseley, which form the healthiest suburb of Birmingham. There is a good deal of typhoid fever at Erdington; diarrhœa is rare. Diarrhœa and typhoid fever are both common at Water Orton. Fever occasionally prevails at Sutton Coldfield; diarrhœa is not common; bronchocele is very prevalent. Ague is unknown in any of those places.

Henley-in-Arden.—District rural; chiefly in pasture and green crops. The country is undulating, the hills being low; the soil is reddish clay and marl. Water is obtained from wells and small streams; it is hard. No endemic diseases prevail.

WORCESTERSHIRE: Dudley.—The country is hilly; the soil strong, deep clay. The town is very imperfectly drained. Sedgley, a parish in the registration district, in which also diphtheria prevailed, is high. A large portion of the surface is occupied by mines, buildings, and black waste; the rest is fairly cultivated. Pools of water are common. The village of Gospelend, near Sedgley, where diphtheria likewise prevailed, is at a low level, but the soil is dry and sandy. The water supply is procured from the waterworks and from wells; it is said to be of bad quality from both sources. Ague is a rare disease; typhoid fever and diarrhœa are prevalent. There is a little bronchocele.

Redditch.—The district is comprised within a radius of three miles round the town. The town is situated on a spur of the high land called the Ridgeway; the surrounding country is broken into hill and valley. The soil is in parts marl; in others gravel. The rural district is well cultivated, and the drainage moderately good. The town is not densely built. The water is procured from wells; is hard, and contains a notable quantity of nitrate of ammonia. Autumnal fever and diarrhœa are very common; bronchocele eminently so. Diabetes also prevails through a distinctly marked portion of the district.

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STAFFORDSHIRE: Wolverhampton is high, and not densely built. Diphtheria has prevailed more in the rural districts than in the town, Penn and Wimbourn having been its especial seats. Penn is elevated; the soil a cold clay; drainage indifferent; buildings scattered. Water is obtained from the waterworks and from wells. The former is of good quality; the latter liable to be contaminated by the percolation of sulliage. Ague is not known. Diarrhœa is common in the town, and bronchocele in the neighbourhood.

West Bromwich—High, but level and exposed; soil partly gravel, partly clay. The new red sandstone crops out in places. Natural drainage good. Sewers do not exist. Houses somewhat huddled together. Population dense. The water supply is defective in quantity, is calcareous, and obtained from wells. Autumnal diarrhœa is prevalent. No ague or bronchocele.

Barton-under-Needwood, where diphtheria occurred some years anterior to the present epidemic, is a flat but well-drained district.

Leek.—Although actually at a high elevation, and situated on a hill, the town of Leek is relatively low, being surrounded by higher hills at a short distance; the soil is partly sandy, partly clay. The buildings are not densely arranged on the surface of the soil. The water supply is from springs and surface water, collected in a reservoir at some distance from the town; it is good, but hard. Ague does not exist. Autumnal diarrhœa and typhoid fever are sometimes prevalent. Bronchocele is common.

CHESHIRE: Nantwich is a marshy district. Diphtheria has especially prevailed at Wybunbury and in the town of Nantwich, the latter being a low flat district, the former marshy. The town is, for a small country town, rather densely built. The supply of water is abundant, but not of good quality. Ague is said to be rare; continued fever not uncommon; bronchocele common.

NORFOLK: Cromer is high for Norfolk; there is no marshy land in the immediate neighbourhood. The soil, chiefly gravel, with here and there a little clay, is well drained. Diphtheria is thought to have been worst upon the clay. The water is hard, and insufficient in quantity. As a rule, ague has not occurred, but it suddenly showed itself among the residents in the year 1858, when from 12 to 20 cases occurred in the course of two or three months. It was in every instance referred to some definite local source of malaria.

North Walsham.—The town is rather high; the soil dry, light, and well drained. The epidemic of diphtheria was very severe at Trimingham, which is the highest part of Norfolk, and also at another parish in the union which is marshy. It also prevailed equally on the sea coast as inland. The water supply is from wells, and of good quality. Ague, formerly prevalent, is now rare; diarrhœa is rather prevalent; fever less so than formerly.

Coltishall is a rural, well-cultivated, well-drained district, the soil of which is light and sandy. Typhoid fever was very prevalent in one of the parishes two years ago, Dr. Evans, my informant, having had as many as 70 cases. Only one case of diphtheria has occurred in that parish.

Stalham is low, damp, and flat. There are several small lakes and a good deal of marshy land in the vicinity, but much drainage has been recently effected. Ague, formerly very common, is now comparatively rare; both typhus and typhoid fever are common; diarrhœa is uncommon.

Smallburgh is flat and fenny. Dilham, where there has been a great deal of diphtheria, is marshy, but much has latterly been done in the way of drainage, since which ague has become comparatively rare. Neither fever nor diarrhœa are prevalent diseases.

II. Duration and Extent of the Epidemic.

ESSEX: Brentwood.—Commenced late in the autumn of 1858, and still continued at the time of inquiry (April 14th, 1859). About 20 cases, three of them fatal, occurred in the practice of Dr. Growse.

Tolleshunt d'Arcy.—One case six months ago; no more until two months ago; is now (May 1859) prevalent. About 50 cases, four of them fatal, have occurred in the practice of Dr. Walker. The great majority of the cases were single. At most there have been two cases in a house.

Maldon.—First case seen in August 1858; became epidemic in the following month; last case seen was on one of the last days of February 1859. Upwards of 300 cases came under the care of the Messrs. May. Of 129 cases treated between the commencement of the epidemic in August and the beginning of December, 17 proved fatal. The epidemic has latterly been milder, and the recoveries more numerous. Mr. May saw a case of diphtheria at Danbury twenty years ago.

Southminster.—First case in July 1858; last in February 1859. The disease first appeared at Tillingham. There have been about 40 cases, of which 16 were fatal. The disease was generally diffused.

Witham.—The first case was in June 1858; the last in February 1859. Ten or a dozen cases, of which four died. The fatal cases were in separate houses, and two of them at different villages, namely, one at Wickham and one at Hatfield.

SUFFOLK: Sudbury.—The first case at Foxearth was in June; the last in July 1858. The first case at Bulmer was on June 25th, 1858. Mr. Mason has had four cases at Bulmer, of which two died. The two fatal cases were in the same family; the other cases were in separate houses. Mr. Shorter had, likewise four cases in Bulmer, of which two were fatal. The first fatal case, aged eight years, was a single case; the second

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fatal case, aged eight years, was in the same house with two other cases, aged 6 and 13 years respectively, both of which recovered. Two deaths occurred at Foxearth ; but one member of the family came from school convalescent from diphtheria, and two others died of the same disease after their removal to Lowestoft for change of air. There were at least five unquestionable cases of diphtheria in this family, and all the other members of the household, ten in number, had sore throat, which is said to have been unattended by exudation. The disease was limited to this house. Mr. Shorter saw cases of diphtheria characterised by the ash-coloured false membrane, at Bury St. Edmund's, previous to the present epidemic.

Lowestoft.—There was a group of cases in a school in April 1858 ; a second group in July, from which time cases continued to occur through August, September, and October, and occasionally, to the time of inquiry, in April 1859. The first case at Gisleham was on December 13th, 1858, the last on March 3d, 1859. From 30 to 40 cases were reported by Mr. Worthington, as having been under his care ; but they were not all attended by the characteristic exudation. Four of these cases proved fatal. Of the fatal cases two were those from Foxearth, near Sudbury, already mentioned, who were ailing when they arrived at Lowestoft. The other two deaths occurred in a parsonage-house at Gisleham, where Mr. Cleveland also had six cases, one of which proved fatal. No indigenous fatal case was heard of in the town of Lowestoft, and some of the medical men had not seen a single case.

DERBYSHIRE: Belper.—No accurate facts could be obtained. Mr. Allen, Union Medical Officer, had seen many cases of malignant scarlet fever unattended by rash. The symptoms were, however, sometimes those of diphtheria, namely, throat covered with a whitish or ash-coloured secretion ; subjacent membrane deeply congested, red, not excavated, rarely ulcerated. The disease was of low type; the cervical glands were enlarged ; there was husky cough and "sibilant breathing," and blistered surfaces sloughed. The same gentleman saw a single genuine case 8 or 10 years ago. The throat was covered with a membrane, which on being removed was renewed on the following day ; croupy symptoms supervened, and the patient died.

Wirksworth.—The first case occurred on October 22nd, 1858. There were still cases under treatment in March 1859, down to which date about 30 cases, of which 10 died, had come under the care of Dr. Webb. The 30 cases were distributed in about 24 houses, and were all attended by the characteristic exudation. Dr. Webb saw some cases at Barton-under-Needwood in 1848 or 1849, in his father's practice. They were also seen by Mr. Birch.

Derby.—First case in October 1858. Cases still under treatment in April 1859.

GLOUCESTERSHIRE: Dursley.—First case, February 27th 1858. This formed one of a group of three cases at Cam. No

other case occurred until early in 1859, when another group of five cases also occurred at Cam. The next case was on June 9th, 1859, from which time the disease continued to prevail more or less until my visit in July, at which time the epidemic was apparently at its height. Very few cases had occurred in the town of Dursley. The three cases in February 1858 were all in the same house; one of them was fatal. Several fatal cases occurred intermediately in the more distant villages in a scattered manner, but full particulars of their history could not be obtained. Mr. Leonard, Union Medical Officer, had 113 cases between June 9th and July 17th, 1859, of which 101 belonged to the parish of Cam; only 12 to Dursley. Some, at least, of these cases were attended by the characteristic exudation; in others the throat presented only a glazy appearance.

HAMPSHIRE: *Christchurch.*—The first authentic case was in September 1858, and cases occurred as recently as October 1859. There was a rumour of the disease having appeared in Bournmouth earlier than September, 1858 which I was unable to authenticate. The first fatal and unquestionable case died on September 11th, 1858. The first case in the hamlet of Holdenhurst proved fatal on October 31st, 1858. No fatal case occurred in the district between November 15th, 1858, and January 16th, 1859, after which date the longest interval without the occurrence of fatal cases down to the first week in August was four weeks. The number of cases is uncertain, but as nearly as could be discovered there had been altogether about 100 cases in the Christchurch Union down to August 30th, 1859. Mr. Goddard had then had 12 cases; namely, six in the parish of Wilton, none of them fatal; six in the parish of Christchurch, of which two died. Mr. Stevens had seen only four cases; Mr. Welch had treated from 25 to 30 cases, of which three at Holdenhurst were fatal. Several of Mr. Welch's cases were in the eastern division of the union, but none of them had the characteristic exudation. More than three fourths of the cases occurred in the western division of the union, and 68 of them in the public and private practice of Mr. Palmer and his assistant, Mr. Fitz Maurice; the former of whom is Union Medical Officer for the district. Of Mr. Palmer's cases 18 died. Altogether 32 deaths were registered during the prevalence of diphtheria under the name of "diphtheria," or of "malignant sore-throat," or "throat disease," or "inflammation of the throat and lungs," and several deaths have been registered as caused by "croup," or "laryngitis," or by "inflammation of the lungs" or by "internal disease and obstruction of bowels," or as "fever, and disease of the lungs," which on local inquiry there is reason to consider as having been caused by diphtheria. Two deaths also occurred which had not been registered at the time of the inquiry, and a third was dying. Of the 32 unquestionable deaths from diphtheria, 29 were in the western division of the district, only three in the eastern. Most of the 29 deaths in the western division of the union were on the west side of the Stour, which

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intersects the district; six of them were at Bournemouth; three at Redhill; eight at Holdenhurst; four at Throop; three at Muscliff; one at Longmoor; one at Moredown; one at Wick; one at Blackwater; and two at Strouden. Five deaths have occurred at Strouden since the inquiry, making seven members of the same family, viz., father, mother, and five children, who have died of diphtheria. Of these seven cases one died on March 15th, one on June 9th, and the remaining five since that date. The three deaths in the eastern division of the union were in separate hamlets at some distance from one another. One of them occurred in December 1858, and two in January 1859. Mr. Falls of Bournemouth saw a fatal case of diphtheria at Hampstead, near London, three years ago; and Mr. Stevens says that when in practice in the fens of Cambridgeshire he saw, perhaps, a dozen cases of diphtheria of the vagina.

LINCOLNSHIRE: Spalding.—Mr. Wilkinson of Spalding saw cases, several of them fatal, at Whaplode Drove, ten miles from Spalding, in July 1856. The first case died on or about the 8th of that month, and the disease spread through the family and into the village. The same gentleman mentioned his having had a case at Spalding in September 1857; but the majority of the medical men mentioned May and June 1858 as the time of the general outbreak in Spalding. Mr. Stiles of Pinchbeck had cases early in March 1858, and it was generally agreed that the outbreak took place earlier in that neighbourhood than in the town of Spalding. The disease appeared at Moulton in September 1858. Diphtheria still prevailed, although less generally, in Spalding and its vicinity, in March 1859. It is calculated that 1,000 cases have occurred in the town of Spalding and its immediate neighbourhood; but it is quite certain that a very large proportion of these have not presented the characteristic exudation, a fact which several of the medical men attribute to the efficacy of the local treatment. Dr. Morris reckoned that he had seen nearly 200 cases, of which five, aged 11, 8, 5, 3, and 2 years respectively, died. Mr. Wilkinson reports 30 cases between September 1857 and April 1858, and 170 at least between April 1858 and the date of inquiry (March 20, 1859). Of these 200 cases only two proved fatal. Mr. Balls has had about 160 cases, of which 17 have died. 65 of these cases, including nine deaths, were distributed in 35 houses. The particulars of these 65 cases, as reported by Dr. Capron of Guildford, who was assistant to Mr. Balls at the time, and kept notes of the cases which came under his observation, are comprised in the subjoined table :—

Table of Cases of Diphtheria occurring in the practice of Mr. Ball at Spalding, Lincolnshire, 1858.
Reported by Dr. Capron.

No.	Name.	Age.	When first seen.	Results.	Nature of Case, &c. &c.
		Years.	1858		
1	H. S.	5	June 26	Died June 27	Left tonsil, uvula, and adjacent soft palate in a state of gangrene. Died the next day.
2	A. M.	4	„ „	Died „ 28	Disease extended to air passages; croupy respiration. Death on the 28th of June.
3	W. M.	6	„ „	Died July 6	Enlarged tonsils, with slight membranous exudation. Death from collapse, on July 6.
4	C. M.	8	„ „	Died „ 17	Like the former, and large abscess in cellular tissue of neck. Death from collapse July 17.
5	F. O.	3	July 2	Recovered	White patches of lymph on tonsils, and palate with superficial ulceration.
6	H. O.	8 months	„ 8	Died July 13	Patches of lymph on tonsils, palate, tongue, and gums; tracheal symptoms. Death, July 13.
7	— O.	15	„ 16	Recovered	Injection of the fauces, and œdema of uvula; went into Yorkshire, and had a recurrence of the affection.
8	E. H.	20	„ 20	„	A severe case; commenced like quinsey, and deep ulceration followed; much constitutional disturbance.
9	— K.	2	„ „	„	Injection of fauces and enlargement of tonsils.
10	Y. H.	2½	„ 21	„	Do. do. do.
11	W. C.	6	„ 22	„	Do. do. do.
12	E. E.	11	„ 24	„	Aphthous ulceration of gums and mucous lining of cheeks following removal of tooth.
13	— L.	40	„ 26	„	Injection of fauces and œdema of uvula.
14	A. T.	8	August 1	Died August 4	Sloughing and gangrene of tonsils and uvula; death from asphyxia; a very rapid case.
15	R. M.	21	„ 4	Recovered	Excavated ulcers of both tonsils; treated locally with liquor sodæ chlorinat.
16	S. M.	30	„ 4	„	Slight ulceration of tonsils.
17	Mrs. S.	24	„ 5	„	Exudation of lymph, and deep ulceration of tonsils, followed by aphonia, and paralysis of the muscles of the soft palate.
18	Mr. S.	25	„ 5	„	Injection of fauces and obscure difficulty of swallowing; pain in the centre of sternum.
19	H. S.	16	„ 5	Died August 27	Ulceration, recovery, sudden collapse; symptoms of perforation of stomach. Death in 30 hours.
20	T. N.	9	„ 5	Recovered	Extensive ulceration of both tonsils.
21	Mr. A.	40	„ 17	„	Commenced like quinsy; tonsils were incised, and the incisions became covered with lymph.
22	E. D.	16	„ 19	„	Ulceration of both tonsils.
23	Y. P.	22	„ 24	„	Ulceration do. do.
24	E. Y.	3	„ 21	„	Ulceration; recovery; had a relapse October 9, with exudation of lymph.
25	A. H.	3	„ 23	„	Superficial ulceration, with long standing chronic enlargement.
26	S. W.	8	„ 7	„	Aphthous ulceration of gums, cheeks, and tongue; no affection of fauces.
27	E. H.	5	„ 29	„	Chronic enlargement of tonsils following slight ulceration.
28	— B.	17	September 4	„	Injection of fauces and enlarged tonsils.
29	R. T.	21	„ 7	„	Enlargement and ulceration of tonsils.
30	E. R.	18	„ 12	„	Deep ulceration of tonsils.
31	— D.	10	„ 13	„	Injection of fauces.
32	A. P.	19	August 27	„	Ulceration and enlargement of tonsils.
33	Miss H.	8	„ 28	„	Do. do.
34	M. B.	15	„ „	„	Do. do.
35	M. B.	14	„ 29	„	Do. do.

TABLE of CASES of DIPHTHERIA reported by Dr. CAPRON—*continued.*

No.	Name.	Age.	When first seen.	Results.	Nature of Case, &c. &c.
		Years.	1858		
36	Miss C.	12	September 3	Recovered	Ulceration of tonsils.
37	Miss S.	18	„ 16	„	Extensive ulceration, with high inflammatory fever.
38	W. H.	38	„ 28	„	Redness and ulceration of fauces.
39	C. P.	10	„ 29	„	Ulceration of tonsils, severe fever, and well marked eruption over the whole body.
40	M. P.	7	„ „	„	Do. and enlargement of tonsils.
41	J. P.	5	„ „	„	Do. of tonsils, fever, and eruption. Same as case 39.
42	R. P.	3	„ „	„	Enlarged tonsils; no other symptoms.
43	Mr. P.	40	„ 30	„	Ulceration of both tonsils.
44	J. M.	25	October 13	„	Do. do.
45	C. M.	30	„ 15	„	Sloughing of right tonsil.
46	E. C.	4	„ 14	Died October 18	Gangrene of tonsils and soft palate; fetid and sanious discharge from nostrils.
47	F. B.	4	„ 12	Died October 25	Gangrene of tonsils, uvula, and palate; pain in epigastrium; obstinate vomiting; epistaxis.
48	Miss A.	14	„ 18	Recovered	Ulceration of tonsils.
49	Miss S.	16	„ 18	„	Do. do.
50	Miss S.	15	„ 20	„	Do. and enlargement of tonsils; epistaxis.
51	S. R.	17	„ 19	„	Slight ulceration of tonsils.
52	A. W.	12	„ 20	„	Ulceration of tonsils; epistaxis.
53	G. O.	13	„ 21	„	Exudation of lymph; excavated ulcer of left tonsil; odema of uvula; a severe case.
54	H. V.	15	„ 22	„	Ulceration and enlargement of left tonsil.
55	Miss W.	14	„ 26	„	Ulceration of both tonsils; severe febrile disturbance; recovery; relapse.
56	Miss L.	10	„ 27	„	Do. of tonsils.
57	Miss P.	10	„ „	„	Do. do.
58	Miss H.	6	„ 28	„	Do. do.
59	Mrs. P.	26	„ 29	„	Do. of left tonsil.
60	E. C.	12	„ „	„	Slight ulceration.
61	R. W.	14	„ 30	„	Do. do.
62	E. W.	10	„ „	„	Do. do.
63	R. W.	5½	„ „	„	Enlarged tonsil.
64	Miss R.	20	November 1	„	Ulceration of left tonsil.
65	E. S.	2	„ „	„	Abscess of neck.

Houses attacked, 35.

Cases under 10 years of age	24
„ from 10 to 20 years	26
„ above 20 years	15
	65

The greatest number occurring in one house (a school), 8. In 5 instances 4 cases occurred in the same house. Only 18 were isolated cases, and in most of these the inmates of the house were few, and included no children.

Dr. Cammack saw a solitary case four or five years since. Mr. Stiles of Pinchbeck supposes he has had 500 cases, 300 of which occurred in the space of about six weeks; 19 of these died, chiefly at the beginning of the epidemic. Many of the cases had not the characteristic membrane. Mr. Elsdale of Moulton has had 29 cases, of which 5 died; the cases were distributed in 12 houses.

Horncastle.—First case on July 24th, 1858. Cases were still under treatment at the end of March 1859. Mr. Snaith says he has had at least 300 cases, of which about 10 have died. 510 cases have been treated at the Horncastle Dispensary, of which 12 proved fatal.

Coningsby.—The first case was in May 1858. The epidemic was most prevalent from July to October, but cases continued to occur as lately as June 1859. Mr. Lambden has seen about 200 cases, 13 of which proved fatal. Of the fatal cases 7 were between the outbreak of the epidemic in May and November 1st, 1858; the other six occurred between April and the end of June 1859. One or more cases of diphtheria complicating scarlet fever have since died. Mr. Lambden has seen a case or two of diphtheria annually since he commenced practice in Coningsby, and there are traditions among the country people of the occurrence of precisely similar cases as long ago as 25 years.

*WARWICKSHIRE: Birmingham.**—Dr. Heslop and other medical practitioners saw cases as early as August 1856, and the disease has never since been entirely absent from the town (April 1859). The earliest cases at Erdington were in January 1856, when five fatal cases occurred at Bromford Forge, near the river Tame; the last cases were in February 1859. Cases occurred at Water Orton in December 1856, but the severest outbreak was in January, February, and March 1858. The first case at Highgate was on November 11th, 1856; the last in February 1859. No records exist from which the number of cases can be estimated. Including 30 fatal cases, Mr. West has treated about 100 cases in 70 houses; Mr. Jauncy 10 cases, of which 1 fatal; Dr. Fleming 4 cases in separate houses, of which 1 fatal; Mr. Bindley 5 cases, none of them fatal; Mr. G. Elkington of Edgbaston about 12 cases, of which 4 died. Mr. Oates of Erdington has had many cases, only 7 deaths. Mr. Chavasse has had 15 cases, 3 deaths. Mr. H. S. Chavasse of Sutton Coldfield 10 cases, of which 3 have died. Mr. Schofield of Highgate has treated more than 100 cases in nearly as many houses, of which 12 have proved fatal. The particulars of these 12 fatal cases are given in the subjoined table:—

* [In 1836, cases of diphtheria were observed at Birmingham chiefly in connexion with measles. See Mr. Ryland's Treatise on Diseases and Injuries of the Larynx and Trachea, London, 1837, pp. 161–175.—J. S.]

TABLE of fatal Cases of DIPHTHERIA in the practice of Mr. Schofield of Highgate, Birmingham.

Date.	Name.	Age.	Sex.	Residence.	Condition of House.	Duration of Disease.	Immediate cause of Death.	Remarks.
1856. Nov. 11	E. B.	3 years	F.	Spark-Brook, clayey, damp.	Damp.	About 5 days	Asthenia	Only seen when moribund. Scarlatina was prevalent in this neighbourhood, and was accompanied with diphtheria.
1857. Jan. 10	A. E.	4 years	Brother and Sister	Moseley, sandy, dry.	New house, not well dried.	7 days	Asthenia	A third child was attacked before the second death, but recovered.
„ 14	K. E.	5 „				7 days		
Feb. 25	H. R.	20 years	F.	Highgate, clayey.	Water in cellar	12 days	Asthenia	This girl was my own servant, a strong and healthy young woman. In addition to having water in the cellar, I was myself confined to my bed by a very severe attack of erysipelas of the head and face when the diphtheria first appeared.
March 14	G. B.	6 years	F.	Balsall Heath	Damp, stagnant ditch in front.	4 days	Asthenia	This child's mother was confined a day or two before she was attacked, and lay in the same room with her during the whole of her illness without injury to herself or infant. No other member of the family suffered.
April 2	A. G.	2 years	F.	Moseley	Dry, near residence of cases 2 and 3	Scarlatina, 18 days, Diphtheria, 12 days, Croup, 3 hours.	Croup	Two other children in this house had scarlatina at the same time and one diphtheria; the other, the eldest, had a very mild attack of scarlatina without any throat disease.
April 11	W. H.	2 years	M.	Balsall Heath	Dry, privy close to kitchen door.	Diphtheria, followed by six weeks' exhaustion.	Asthenia	This child, after a severe attack, appeared rapidly recovering, but suddenly commenced wasting away without apparent cause, and died extremely emaciated.
May 6	J. L.	15 years	F.	Spark-Brook	No cellar, street not drained.	8 days	Asthenia	Probably preceded by quinsey.

1858. Jan. 1 -	E. T.	8 months	M. - -	—	—	Scarlatina, with diphtheria, 5 days.	Croup -	Imported from valley of the Tame, where under care of Dr. Barker. Moribund when seen by me.
Nov. 25 -	W. R.	15 years	M. - -	Spark Brook -	Same as last -	Typhoid fever 14 days, diphtheria 3 days.	Asthenia -	Typhoid fever has been prevalent in the row of ten houses in which this patient lived more or less till the present time, but there have been no other cases of diphtheria.
Dec. 22 -	C. R.	4 years	F. - -	Spark Brook -	Damp - -	Scarlatina, diphtheria.	Croup -	There were seven cases of scarlatina, one fatal from dropsy, in this house, and the next (case 1. occurred here) and a fatal case of diphtheria, under the care of another practitioner, within a few days of my patient's (a brother).
1859. Jan. 6 -	J. H.	11 years	F. - -	Highgate - -	Damp - -	Scarlatina, diphtheria about three weeks.	Asthenia -	This case was only seen after death, and was the second that happened suddenly in the same house. The parents said the girl had scarlatina three weeks ago; got tolerably well; had sore throat for a day or two, but not badly; began to sink during the night, and had been dead a few minutes when I saw her at 7 a.m. There was abundant diphtheritic membrane on the tonsils and back of the mouth. An inquest was held in the former case, but no medical evidence called.
Jan. 30 -	D. L.	12 years	M. - -	Highgate - -	Dry; well drained; best house in the place.	8 days - -	Asthenia -	Imported from Gloucester. Had enlarged tonsils; threatened with croup on the seventh day, but recovered; died comatose and exhausted. The only death from uncomplicated diphtheria since May 6, 1857.*

* This table does not include many deaths where diphtheria was only a complication, death being attributable to some other disease, ordinarily to scarlet fever.

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Dr. Keyworth saw cases at Sittingbourne in Kent, in 1845, and in St. Thomas' Hospital in 1848 or 1849. Dr. Wade saw a case in the General Hospital, Birmingham, in 1854. Dr. Russell saw two cases in Herefordshire in 1848 or 1849, and Dr. Fleming saw three well-marked cases in Cork in 1856. There was no epidemic in Cork at the time;—they were typical cases, and all recovered. Dr. Heslop saw a case complicating typhoid fever several years ago.

Henley-in-Arden.—The first case here occurred in December 1858, and solitary cases still continued to appear at the end of April 1859. About 30 cases occurred in Dr. Ager's practice, in 8 houses; only 1 of them fatal.

WORCESTERSHIRE: Dudley.—The first case here was in October 1857. Cases still occurred in April 1859. Mr. Houghton had seen only six cases in different houses, one of them fatal.

Redditch.—First case October 20th, 1858; last case February 22nd, 1859. Dr. Nicholson reports having seen cases early in the autumn of 1858, and as late as March 1859. Mr. Smith reports about 40 cases in 10 houses, of which 7 fatal. Dr. Nicholson more than 100 cases; 3 fatal.

STAFFORDSHIRE: Wolverhampton.—Diphtheria appeared here as early as the summer of 1857; was most prevalent in the early part of 1858, and continued until the summer of 1859. Accurate statistics could not be procured. The late Mr. Edwardes saw four fatal cases at Brewood in the summer of 1857; these were the earliest recorded cases in the district. The next case seen by the same practitioner was in December 1857, from which time the disease became general. Mr. Dehane kept no separate record, but had seen about 100 cases of scarlatina and diphtheria, of which about 8 were fatal. Mr. Coleman's cases were isolated, and not numerous; deaths 8. Mr. Dunn had seen 9 fatal cases, 2 in one house, 5 in another, and 2 cases singly in separate houses. There had been 9 or 10 cases at Penn, of which 7,—4 adults and 3 children,—which all recovered, were in a single farmhouse; of 2 others in a neighbouring cottage, 1 was already dead, the second in a doubtful state, when I visited the village.

The following list of cases has been furnished by Dr. Topham, senior physician to the South Staffordshire General Hospital:—

1*st case*—seen January 4th, 1858. A little girl, residing on the outskirts of the town; a mild case, which soon recovered.

2*d case*—June 9th, 1858. A young girl, residing in the centre of the town; a mild case, which soon recovered.

3*d case*—Nov. 3d, 1858. A middle-aged man, residing in the centre of the town; was a severe case, but ultimately recovered.

4*th case*—January 4th, 1859. A little girl, residing in the country; a very severe case; had been ill four days before

she was seen, and proved fatal on the seventh day, from exhaustion following hemorrhage from the throat.

5th case—January 7th, 1859. A little boy, residing in the country, a mile from case No. 4; a mild case, which soon recovered.

6th case—January 25th, 1859. A little boy, in the same family as the 4th case; a severe and protracted case, which eventually recovered.

7th case—February 8th, 1859. A little boy, in the same family with the 4th and 6th cases; a severe case; died on the ninth day, from exhaustion following hemorrhage from the throat.

8th case—February 9th, 1859. A little girl, residing in an elevated situation in the country. It was a mild case, but was followed by partial amaurosis and partial paralysis of the lower extremities, from which, after an interval of six months, she recovered.

9th case—February 20th, 1859. A young woman in service, residing in Wolverhampton; a slight case, which soon recovered.

10th case—February 22d, 1859. A lady, mistress of No. 9; a severe case, but recovered.

11th case—March 2d, 1859. A little girl, child of No. 10; also a slight case, which soon recovered.

These are the only cases seen by Dr. Topham in which the peculiar exudation has appeared on the throat in any quantity; but he saw many in which there have been small points or granular looking masses which have not spread.

West Bromwich.—First case in October 1857; but Mr. Duncalf, the reporter, had previously seen a case at Dudley in the preceding August in connexion with some cases of scarlet fever. The last case had been recently seen at the period of inquiry in April 1859. Mr. Duncalf had had four cases in three houses; two fatal.

Barton-under-Needwood.—One case, not fatal, is reported by Mr. Birch during the present epidemic. Saw several cases, three of which died, in 1851 or 1852. The cases referred to by Dr. Webb of Wirksworth formed part of this group, neither Mr. Birch nor Dr. Webb being quite certain as to the year of their occurrence. These were genuine cases of diphtheria, attended by exudation in the pharynx, extending, in two cases examined after death, through the glottis into the windpipe, and downwards into the bronchial tubes.

Leek.—First case about July 1856. Cases still occurred so lately as March 1859. No trustworthy statistics could be obtained. At first nearly all the severe cases were fatal; latterly most of the cases have recovered. The number of houses has not amounted to half the number of cases.

CHESHIRE: Nantwich.—The first cases were seen by Dr. Bellyse at Wybunbury early in 1858. Dr. Brady and

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Mr. Williamson both said no cases had occurred in the town of Nantwich until late in 1858 or early in 1859, and the last case they had seen at the time of my visit was in March 1859. Dr. Bellyse reports upwards of 50 cases, of which 3 fatal; 30 of the 50 had the characteristic membrane. Dr. Brady has seen 13 cases, 3 of which have died; Mr. Williamson under 30 cases, 9 or 10 of which have died. Only one of the latter was in the town of Nantwich.

NORFOLK: Cromer.—The first cases were seen in August 1858, and cases were still under treatment in April 1859. The disease has appeared at different periods in the several surrounding parishes, sometimes migrating from parish to parish, in other instances appearing at a more distant point. Probably 200 cases have occurred. All are said to have had the characteristic exudation on the throat, but sometimes it was very slight. Eight of the cases terminated fatally; viz., two in each of three separate houses; the remaining two singly. Mr. Cooper saw a few cases of diphtheria in a marshy district near Yarmouth some 10 or 12 years ago. They were neither numerous nor so severe as those he has seen during the present epidemic.

North Walsham.—First cases in October 1857. The principal prevalence of the epidemic was in November and December 1857 and the early part of 1858. There was then a lull, after which it broke out in other parishes of the union, but it never altogether disappeared, and cases still occurred as late as the time of inquiry in April 1859. Mr. Prentice has treated from 280 to 300 cases; about 30 of which proved fatal: Mr. Mende about 100 cases; 12 or 15 of them fatal: Mr. Coleby and Mr. Shepheard about 100 cases characterized by the membrane, of which about 20 died. Mr. Coleby thinks he witnessed a similar epidemic about the year 1832.

Coltishall.—There was a doubtful case here in December 1858. The earliest unquestionable case was on January 6, 1859. Cases were still under treatment in April 1859. Some cases of croup occurred about the end of 1857, which were probably cases of diphtheria. Dr. Evans has seen 13 cases in six houses; 5 deaths in three houses.

Stalham.—First case in March 1858. The epidemic was the most prevalent in the summer and autumn of 1858, but cases continued to appear so late as April 1859. About 150 cases; deaths 20. Mr. Clowes, who has been in practice here for 30 years, never witnessed the disease before.

Smallburgh.—First case in June 1856; cases still under treatment at the end of April 1859. There have probably been about 200 cases here, of which 35 were fatal. These cases have been in different parishes, but chiefly in Dilham, Honing, Worstead, Smallburgh, and a few in Tunstead.

III. Local Relation of Diphtheria to other Diseases.

ESSEX: Brentwood.—Simple sore throat and quinsy prevailed, but not to a remarkable extent; scarlet fever very extensively, and erysipelas slightly, at the same time with diphtheria.

Tolleshunt D'arcy.—Tonsillitis and relaxed sore throat were very common during the epidemic; they preceded diphtheria, and were fatal in one instance; erysipelas, puerperal fever, and common continued fever also prevailed contemporaneously with diphtheria, as did a low form of influenza among animals, attended by great difficulty in swallowing, refusal of food, and in many cases rapid death.

Maldon.—Sore throat, characterized by enlargement of tonsils, inflammation of uvula, palate, and posterior fauces, but without suppuration or ulceration of the tonsils or fibrinous exudation, prevailed very generally at the same time as diphtheria; there was likewise a very little scarlet fever and a little erysipelas.

Southminster.—Inflamed sore throat, unattended by exudation, and tonsillitis, which did not suppurate, came and departed with diphtheria. They prevailed most extensively, and were often tedious and slow in recovery. A few mild cases of scarlet fever occurred the year before and a few since the departure of the epidemic, but none occurred contemporaneously with it. There has been a good deal of mild typhoid fever recently.

Witham.—Inflamed and ulcerated sore throats accompanied and followed diphtheria; scarlet fever did not prevail about the same time.

SUFFOLK: Sudbury.—Common ulcerated sore throat and tonsillitis prevailed much from May to November, 1858. It was not fatal in a single instance. Intermixed with this milder disease was a severer form of sore throat, unattended by ulceration; the tonsils were swollen, and looked glazy, and it was attended by great depression, requiring the free employment of stimulants. These forms of sore throat prevailed amongst the better classes, and followed a furunculoid epidemic which had lasted during the 18 previous months. Scarlet fever did not exist at the same time as diphtheria. Typhoid fever was very prevalent from July to November 1857.

Lowestoft.—A few cases of sore throat and scarlet fever, but not to an unusual extent, occurred in Lowestoft about the same time with diphtheria. Simple sore throat has been rather common at Gisleham, but scarlet fever neither preceded, accompanied, nor followed diphtheria in that parish.

DERBYSHIRE: Belper.—Throat affections have been the prevailing diseases lately; tonsillitis and pharyngitis prevailed epidemically during the winter of 1858–9. Every case of catarrh has been attended by sore throat. Typhoid fever (attended by diarrhœa) was very prevalent last summer (1858), and scarlet fever, often in the malignant form, both with and without the rash, has recently been very common in Belper and the surround-

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ing parishes. Inflammatory sore throats, with enlarged tonsils and enlongated uvula, were common in Ripley during the winter and spring, and contemporaneously with them a few cases of scarlet fever.

Wirksworth.—Sore throat of low type, often attended by sloughing, was prevalent at the same time as diphtheria. The tonsils were usually swollen; the uvula often sloughed away, and such cases were sometimes fatal. This form of sore throat appeared before diphtheria, and still prevailed in one part of the district in March 1859. Croup had likewise been unusually prevalent. Scarlet fever of very malignant form had existed the neighbourhood for a year. Erysipelas had been prevalent, and also typhoid fever, especially in one elevated but ill-conditioned village. Diphtheria and scarlet fever often co-existed in the same houses.

Derby.—Scarlet fever preceded, accompanied, and succeeded diphtheria in this district. It was of a very severe and fatal form, attended by much glandular swelling, with tendency to rapid sinking. There have been some cases of erysipelas, of puerperal fever, and also of continued fever, and measles has followed diphtheria.

GLOUCESTERSHIRE: Dursley. — Inflammatory sore throat was extremely prevalent, both in Dursley and the neighbourhood, especially in June and July 1859, contemporaneously with the epidemic of diphtheria. It was in no instance fatal. A few cases of scarlet fever had occurred from time to time for many months prior to the epidemic; they were, not fatal, presented no unusual features, and were not commoner in Cam, where diphtheria especially fixed itself, than in the neighbouring parishes. "Mouth and hoof disease," characterised by aphthous ulcerations of the mouth, lips, and nose, by swelling of the fauces, and by vesicles and ulcerations of the feet, was prevalent among cattle and pigs during the spring of 1859.

HAMPSHIRE: Christchurch.—Tonsillitis and common inflamed sore throat were very prevalent, contemporaneously with diphtheria. The inflamed surface was often dotted with aphthous looking white coloured spots. None of these cases were fatal. A disease, called roseola by the medical men, preceded the appearance of diphtheria; it resembled very slight scarlet fever, but was almost unattended by affection of the throat; the rash seldom lasted longer than from two to three days; the fever was slight, and recovery rapid. Scarlatina prevailed in the neighbourhood before diphtheria appeared; was prevalent in the workhouse, where no case of diphtheria occurred during the existence of the epidemic in other places, and I have reason to suppose was intimately intermingled with diphtheria in the western division of the union. The third fatal case, that of a girl named Plowman, was represented by a dissenting minister, who was much with the girl in her last hours, as having been attended by redness of skin, and several

other cases are said to have also been attended by transient redness of surface. Measles likewise prevailed during the presence of diphtheria.

LINCOLNSHIRE: Spalding.—Sore throat unattended by fibrinous exudation was very prevalent in Spalding and the neighbourhood during the epidemic. Some of the medical men attributed the absence of exudation to the efficacy of the local treatment in arresting the disease; but there appears to me no reason for considering these cases as at all different from the prevalent inflammatory sore throat and tonsillitis described as accompanying the epidemic in other places. Cases seen by myself, through the courtesy of their medical attendants, did not differ from cases of the milder form of sore throat, of which I had seen great numbers both in London and the provinces during the prevalence of diphtheria. Dr. Capron, who appears to have studied the epidemic carefully, says these cases of sore throat occurred in the same houses and at the same time with diphtheria; and adds, that he believes they were different forms of the same disease; a conclusion at which most careful observers must have arrived. Scarlet fever occurred in Spalding at the same time, and sometimes was complicated with diphtheria, but it was by no means prevalent, and presented no unusual features, neither was it of a severe form. Cases of sore throat, unattended by exudation, were common at Pinchbeck and also at Moulton contemporaneously with diphtheria; these simpler sore throats were at Moulton attended by great depression, but were never fatal. Scarlet fever "certainly" did not prevail at Pinchbeck about the same time, and no cases had occurred at Moulton since long before the appearance of diphtheria. A form of disease, attended by discharge from the nostrils and fœtor of breath was very prevalent among cattle whilst diphtheria was prevailing. Dr. Morris had seen a horse the mouth and throat of which presented the same appearance as that of a person suffering from diphtheria; the glands about the jaw were also swollen. The animal died, but three other horses affected in the same manner recovered.

Horncastle.—Inflammatory sore throat was prevalent here during the existence of the epidemic, and so was scarlet fever.

Coningsby.—Inflammatory sore throat and tonsillitis, sometimes passing into the suppurative form, appeared at the same time with diphtheria, and continued after its departure. Scarlet fever did not exist in any of the districts around Coningsby during the prevalence of diphtheria in 1858, nor indeed until the summer of 1859, when it appeared at the hamlet of Tattershall Thorpe, where the cases were complicated with diphtheria. I had seen cases of scarlet fever in Horncastle in the preceding March; and as Horncastle is the market town of the district, centre of the union, place of magistrates' sessions, and as there is a dispensary there much frequented by the poor of the surrounding country, the disease was most probably imported directly from thence. Influenza followed diphtheria, both in Coningsby and Horncastle, as

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WARWICKSHIRE: Birmingham.—Inflammatory and ulcerated sore throats, tonsillitis, unaccompanied by suppuration, but often attended by follicular disease, accompanied and followed the epidemic. By several practitioners this milder disease was observed to be the most prevalent when diphtheria was on the wane. These sore throats were often characterized by great depression, and were slow in recovering, but not fatal. The prevalent sore throat was described by Dr. Fletcher as of an erythematous character; by Dr. Fleming as catarrhal sore throat. "The throat in these cases," says Dr. F., "was bright red, and in the early stage unusually dry." At a later stage relaxation occurred, and sometimes there was enlargement of the tonsils, and occasionally superficial ulceration. Dr. Wade said he had sometimes seen suppuration of the tonsils. Scarlet fever is never absent from Birmingham, and existed there, but not to an unusual amount, during the entire prevalence of diphtheria. The throat, in scarlet fever, has often presented the leathery exudation, both in the early stage and as a sequel to the exanthematous affection. A few isolated cases of quinsey only have occurred in the Highgate, Sparkbrook, and Moseley districts, during the epidemic, but scarlet fever, often complicated with diphtheria, has occurred there, and also at Erdington, Sutton Coldfield, and the other places in this district, either contemporaneously with, or shortly before or after diphtheria. Mr. West says scarlatina was frequently observed as the precursor of diphtheria, and sometimes occurred simultaneously with it in the same house. Both erysipelas and puerperal fever, and also typhoid fever, were unusually prevalent contemporaneously with diphtheria. There has also been a prevalence of hæmorrhagic diseases, and especially of purpura. An affection of the mouth and feet ("mouth and hoof disease"), and also pulmonary murrain were said by butchers to have been very prevalent among cattle during 1858 and the early part of 1859.

Henley-in-Arden.—Sore throats, in no instance fatal, preceded, accompanied, and followed diphtheria. So did scarlet fever, which presented no unusual features.

WORCESTERSHIRE: Dudley.—Sore throats were very prevalent in Dudley and at Sedgley, in 1858 and the early months of 1859. At the latter place tonsillitis, and dusky inflammation of the posterior fauces were the prevailing forms of sore throat; the glands at the angles of the jaw were swollen, and there was marked depression. Sometimes it is said there was ulceration of the tonsils, with sloughing; but from the description I am inclined to think the sloughs spoken of were really shreds of false membrane. Scarlet fever was intercurrent with diphtheria at Dudley, indeed it is said never to be absent from that town, and prevailed also at Sedgley in the autumn of 1858. Puerperal fever, especially in the autumn of 1858, erysipelas, and continued fever prevailed in Dudley contemporaneously with

diphtheria. Uterine hæmorrhage prevailed to a most unusual extent, and was in many instances fatal, during the latter part of 1857 and a great part of 1858.

Redditch.—There was not a greater prevalence of sore throat than usual during the epidemic, but on the decline of diphtheria a form of sore throat, characterized by foul ragged ulcers of the tonsils, prevailed. A fœtid greenish acrid discharge, excoriating the neighbouring mucous membranes, flowed from the tonsils. scarlatina of malignant type followed, and erysipelas of severe and unmanageable character commenced, augmented, and declined simultaneously with diphtheria.

STAFFORDSHIRE: Wolverhampton.—Inflammatory and relaxed sore throats, and tonsillitis, sometimes passing into suppuration, were most prevalent during the whole of 1858 and the early months of 1859. These affections were very rarely indeed fatal, only two such, one of tonsillitis and one of ulcerated sore throat, both in the practice of Mr. Coleman, having been reported to me. Scarlet fever and erysipelas were prevalent contemporaneously with diphtheria. Continued fever and measles likewise occurred about the same time. The late Mr. Edwardes wrote, that wherever sickness occurred during the prevalence of the epidemic, it manifested a tendency to put on the diphtheritic character, and likewise that erysipelas, bronchial affections, boils, carbuncles, and skin diseases, had been more prevalent during the last two or three years than he ever remembered. Influenza was general among horses, and the "cattle disease" was very fatal in some rural parts of the district.

West Bromwich.—Aphthous ulceration of the tonsils prevailed to a very great extent, both during and after the prevalence of diphtheria. These cases were attended by much depression, and recovered slowly, but were never fatal. Scarlet and typhoid fevers prevailed much at the same time, and also pleuro-pneumonia among horses and cows, and "foot disease" among pigs and sheep.

Leek.—A milder form of sore throat, considered by some of the medical men as but a milder form of diphtheria, and characterized mainly by swelling and inflammation of the tonsils, prevailed at the same time as diphtheria. The advent of this form of sore throat rather followed than preceded that of diphtheria, and the cases of simpler sore throat became more numerous as those of diphtheria declined. The inflammation did not generally extend to the pharynx, and the tonsils sometimes suppurated. None of the cases of the milder disease proved fatal. Solitary cases of scarlet fever occurred previous to the commencement of the epidemic, prevailed more or less through its whole course, and have continued to appear since diphtheria has departed. At first the epidemic did not very distinctly assume the characters peculiar to diphtheria, but was considered by the medical men as a "low destructive inflammation of the tonsils and adjoining parts, causing sloughs with intolerable stench." It was only at a later period, and

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more than a year after the first outbreak, that the disease unmistakeably assumed the true diphtheritic character. Some of the medical men considered the disease at this early period to be but a malignant form of scarlet fever. The following table shows the number of deaths from typhus and scarlet fever in each of the last nine years, and shows a very manifest increase in the mortality

	1851.	1852.	1853.	1854.	1855.	1856.	1857.	1858.	1859.
Scarlet Fever -	11	19	5	4	1	40	93	—	—
Typhus - -	11	4	11	6	9	8	17	—	—

from the latter, about the commencement and during the prevalence of diphtheria. Both erysipelas and puerperal fever have occurred, especially towards the beginning of 1859, but neither can be said to have been very prevalent.

CHESHIRE: Nantwich.—Inflammatory sore throat and tonsillitis prevailed at the same time with diphtheria, and continued to occur after the departure of the more formidable disease. The tonsils very rarely suppurated. The same fact was noticed at Crewe. Scarlet fever existed in the district at the same time with diphtheria, one of the medical men having seen cases, but it can scarcely be said to have prevailed, as other medical practitioners had no cases during the prevalence of diphtheria. Erysipelas was common during the epidemic, and there were also, about the same time, a few cases of continued and of puerperal fever.

NORFOLK: Cromer.—Simple sore throats and tonsillitis prevailed much, contemporaneously with diphtheria. Scarlatina was prevalent in the winter of 1857–8 and the following spring, but had entirely ceased previous to the appearance of diphtheria, and has not since reappeared. A few cases of erysipelas occurred about the time of the epidemic, but not more than is common. Stomatitis was unusually prevalent.

North Walsham.—Tonsillitis, inflamed and ulcerated sore throats, were common at the same time as diphtheria; they were sometimes attended by swelling of the glands at the angles of the jaw. Scarlet fever was particularly prevalent in the winter of 1857–8, and existed more or less throughout the epidemic. "Mouth and foot disease" prevailed amongst cattle in 1858, and distemper among dogs.

Norwich. — Ordinary tonsillitis and "scarlatinous angina" preceded and accompanied diphtheria in this neighbourhood, and scarlet fever prevailed contemporaneously with it in some districts.

Coltishall.—Inflamed and relaxed sore throat, a few cases of quinsy, and of follicular tonsillitis and malignant sore throat "attended by black sloughs," immediately preceded, accompanied

and continued to prevail after diphtheria. Scarlet fever had prevailed in the district more or less for four years previous to the inquiry (April 1859), but was remarkably mild, and not attended by much throat affection. "Mouth and foot disease" was very common amongst cattle in 1858.

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Stalham.—Inflammatory sore throat, sometimes attended with swelling of the tonsils, but without much indisposition, prevailed at the same time with diphtheria. Scarlet fever did not exist in the district at the commencement of the epidemic, but became very prevalent before the close of the summer of 1858. A few isolated cases of erysipelas occurred during the epidemic.

Smallburgh.—Inflammatory sore throats, affecting sometimes the tonsils only, at others the posterior fauces, were prevalent contemporaneously with diphtheria, and still continued to prevail at the time of inquiry (April 1859). Scarlet fever preceded diphtheria in the district, and continued fever was common at the time of my visit.

IV. Conditions Predisposing to Diphtheria.

CONDITIONS PREDISPOSING TO DIPHTHERIA.

ESSEX: Brentwood.—Diphtheria prevailed alike in dry and damp situations, and in houses of every kind, showing no preference for such as were imperfectly drained or overcrowded. The better classes of society enjoyed no exemption. The epidemic attacked persons from the age of one year and upwards, and in one instance a person aged 60 years.

Tolleshunt D'Arcy.—By far the greatest number of cases, and the severest, occurred in low-lying, damp, and thickly populated parts. Very few, and these milder in character, occurred in thoroughly well-constructed and well-kept dwellings. Nearly all the cases were persons of the labouring class; and infants and children, and persons of a strumous habit, particularly when subject to glandular enlargements, were the most prone to suffer from the epidemic.

Maldon.—At first diphtheria prevailed chiefly in ill-drained, ill-ventilated houses, in the lower portions of the district, and among the poor and ill fed; subsequently it attacked persons of a better class, with ample means, residing in better conditioned houses and in the higher part of the district. Heybridge, a low-lying damp village scarcely raised above the level of the river, very nearly escaped. The epidemic prevailed much at the "Basin" or port, a low-lying place, barely raised above high-water mark, and intersected by foul ditches that receive the droppings of privies, and into which the spring tides occasionally flow for some distance. The country around is marshy, ill drained, and imperfectly cultivated, and the stink from the ditches was said to be almost intolerable in hot weather. Cholera was very prevalent and fatal here in 1854. This is the worst place in the district, but diphtheria did not commence here. Several houses in which cases occurred were visited, and it appeared that condition of dwelling had little or no influence on the disease.

No. 1, a good, clean, roomy, well-ventilated and not overcrowded

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house, the residence of a respectable tradesman. There was a severe and well-marked case, verging on convalescence, in the house at the time of visit.

No. 2, a confined, ill-ventilated, ill-conditioned house of four rooms, two on the ground floor, and two above, but the back room on both floors deriving both its light and ventilation from the front room. The rooms are small, and the house was overcrowded. Six cases of diphtheria, three of them fatal, occurred in this house; father, mother, and one child altogether escaped. None of these cases had previously had scarlet fever.

No. 3, similar in character to number two, but even more overcrowded. Four children had diphtheria, of which two died; a fifth had slight sore throat; the parents and two other children altogether escaped. None of them had previously had scarlet fever.

No. 4, a good well-ventilated roomy house of five rooms. The house stands low, the ground floor is a little damp, but there are no nuisances around, and the house is out of reach of the effluvia from the ditches. The inhabitants are of a better class than those inhabiting numbers 2 and 3. Of the inmates, eight in number, six had diphtheria, of which one died; the child that died had not had scarlet fever; the others had it six years before.

No. 5, a small house of four rooms, but well-ventilated, cleanly, and well-conditioned; the rooms are small. Of eight inmates, four had diphtheria, but the exudation was of the filmy kind, and all recovered. The pre-existence of scarlet fever was very doubtful.

No. 6, a clean, well-ventilated, well-conditioned house of six rooms with only four inmates. Two had diphtheria, of which one died. Both had scarlet fever on a previous occasion.

No. 7, precisely similar to number 6; three inmates, one of whom had diphtheria, and recovered. Had scarlet fever on a former occasion.

Southminster.—The entire district is flat and marshy. Diphtheria did not particularly affect badly constructed or unwholesome or overcrowded houses, and the wealthier classes suffered equally in proportion to their number with the poorer sort. The board of guardians had carried into effect a great many local sanitary improvements within the preceding two years, and previous to the epidemic; privies had been better covered in, ditches had been cleansed and arched over, and the whole place cleansed and put into an improved sanitary state. The houses in which diphtheria occurred had not previously been unhealthy. Persons who suffered from diphtheria had often previously had scarlet fever.

Witham.—Nearly all the cases occurred in dry and airy situations. The disease first appeared in an isolated house, occupied as a ladies' boarding school. It was not overcrowded, and everything relating to the health of the inmates was carefully attended to. One of the cases in this house was fatal. The house at Hatfield in which a death occurred was also free from any conditions which could be supposed to favour the development of the disease; it was not overcrowded, and there existed no bad odour or other discoverable defect. A third fatal case occurred in a house near

to which pigs were kept, the smell from the styes being perceptible within doors. The patients all ranged in age from 3 to 10 years. The child that died at Witham was previously delicate; the others had been healthy. The fatal cases had not previously had scarlet fever.

SUFFOLK : Sudbury.—Of the cases at Bulmer two that were fatal in the same family occurred in a much overcrowded cottage, containing only one bedroom for the accommodation of a family of eight or nine persons. There was no nuisance from defective drainage or collections of decomposing organic matter in the vicinity of the cottages. Two other fatal cases occurred in houses situated high and dry; cleanly, well-ventilated, in good condition, and not overcrowded. The houses had been previously healthy, and although the inmates were of a humble class, the families among whom cases occurred being those of labourers, a coachman, a policeman, and a gamekeeper, they were all as well off as is common with persons of their station, and two of them were in really good circumstances. One of the fatal cases was 18, and the others were all under 12 years of age. The cases at Foxearth occurred in a large well-constructed farmhouse, standing in an open and airy situation on the borders of Essex. As is common in the neighbourhood, the house is surrounded by a moat, but the garden and offices intervened between the house and the moat, which did not, as is usual, receive the drainage of the house. The dwelling was free from obvious defects, and was not overcrowded. The family was in affluent circumstances, and had previously been healthy, but were of a strumous habit.

Lowestoft.—One group of three cases in the more elevated portion of the town excepted, the cases all occurred in the lower district, but neither in damp nor in confined situations. Quite as many cases occurred in the best as in ill-constructed or overcrowded or ill-ventilated houses. No offensive drains or other causes of atmospheric contamination were discovered, but the disease manifested a tendency to linger in a row of recently built first-class houses, most of which had been lately occupied for the first time. The persons affected were mostly in good circumstances. The first case at Gisleham was a member of a family which, although belonging to the humbler class of society, was in a better position and well off. Three or four cases were in the most depressed portion of the parish, and not far from a marsh. A group of cases occurred in the parsonage, two of which died; one of these had, the other had not, previously had scarlet fever. Several of the remaining children, the servants and nurses, amounting to 14 or 15 in all, either had diphtheria or sore throat. The situation of the house is low, rather damp, and it is surrounded with trees. It is a question which was not clearly established whether the disease did not appear first in the parsonage house. The other cases did not occur in overcrowded houses, but they were amongst the labouring class, and in small cottages. The cases were all aged from 2 to 15 years.

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DERBYSHIRE: Wirksworth.—Diphtheria occurred equally in high and dry as in low-lying and damp situations, but is said to have shown a preference for ill-ventilated dwellings. There were several cases in the village of Alderwasley, a healthy, well-drained village, but none of them were fatal. Cesspools and accumulations of organic refuse abound in the outlying villages, but their connexion with the disease was by no means established. The greater proportion of the cases have been among the poorer classes, who form a great majority of the population, but many cases occurred among persons who had all the comforts of life. The epidemic chiefly attacked persons between the ages of 2 and 18 years; older persons exceptionally. Such as were of strumous habit appeared the most liable, and the having previously had scarlet fever afforded no exemption.

Derby.—The epidemic prevailed chiefly in low, damp, undrained, situations, and in the country villages and districts for some time before it appeared in the town. It prevailed mainly amongst the poor, and it was alleged always in objectionable houses, but, on the other hand, cases of very considerable severity occurred among the most affluent. Cases are said to have frequently occurred in newly erected houses. The young were by far the most prone to the disease, but older persons were not exempt.

GLOUCESTERSHIRE: Dursley.—Diphtheria first appeared in the lower part of Cam, near the river, but afterwards extended up the hill. It was said that the worst cases occurred in the lower situation, where cholera prevailed at the last visitation and diphtheria now first appeared. The disease attacked all classes of the community, the affluent as well as the indigent, and those residing in well-conditioned dwellings as well as those living in worse constructed or overcrowded cottages. The outbreak in Cam was singularly mild, but very general. Several cases, four of which were examined by myself, occurred at Richard's Mill, a well-placed row of houses, separated from the mill-stream by a space of garden ground not exceeding thirty or forty yards in breadth. The houses were clean, well-ventilated, and free from any discoverable conditions likely to prove injurious to health. Three cases, two of them presenting the exudation on the tonsils or posterior fauces, at the time of visit, were seen in a farmhouse at Upper Cam. The house itself was unobjectionable, but very near to it was a large, filthy, stagnant pond, the water of which was brown from the admixture of the drainage from a foul privy, from pigstyes, and from farm-yard manure. Two cases of diphtheria, one convalescing, the other still presenting the characteristic exudation on the throat, were seen at Rose Cottage School, Upper Cam. There were eleven boarders in the school, most of whom were seen; all of them had sore throats, although only two had diphtheria attended by exudation. The cottage is pleasantly situated on the side of a hill, is considerably elevated above the roadway, and no nuisance existed in its vicinity, neither could the outbreak of sickness, so far as I could discover, be attributed to

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the existence of any local cause. I visited several houses in which cases of diphtheria had occurred, including a gentleman's house standing in grounds somewhat elevated above but on the bank of the river. It was in all respects a well-conditioned house; but one case of sore throat, attended, when I saw it, by exudation upon the left tonsil, and several milder cases, had occurred among the children. The cottages visited were generally well ventilated, free from obvious nuisances, and, certainly, upon the whole, very superior to the greater number of such residences. Most of them have garden ground in their rear. In one or two instances, but not generally, the privies were in an offensive state; and behind one row of cottages occupied by weavers were large urine tubs, sunk in the ground at intervals, into which the urine is collected from the several cottages, and sold for scouring cloth. Diphtheria did not occur at all more commonly nor more severely in the cottages near these local nuisances, than in such as were more remote. The epidemic chiefly attacked children, but many adults were likewise affected. Of 113 cases seen by Mr. Leonard, 63 were under 10 years of age and 17 above 20, ranging up to 47, and in one case to 65 years of age.

HAMPSHIRE: Christ Church.—The majority of the cases were in the neighbourhood of the river, on the margin of which the greatest proportion of the people reside; but Redhill and other more elevated and dry situations, probably suffered as much, in proportion to the number of their inhabitants, from the epidemic as lower lying places. The population is almost exclusively composed of the agricultural and labouring classes; but diphtheria prevailed equally among families that were well off as among the poorer sort; among those who lived in well-conditioned, airy, and roomy dwellings, as in overcrowded cottages near to nuisances. All the inmates, seven in number, of a very clean, well-conditioned, well-kept cottage at Strouden were successively carried off by the disease. The following is a tabular abstract of the results of an inspection of the district and houses in which the epidemic chiefly prevailed:—

Residence.	Name.	No. of Persons in Family.	Cases of Diphtheria.	Ages of Sick.	Result.	Station.	Source of Water Supply.	Date.	Remarks.
LONGMOOR -	Vatter -	5	1	Years. 4	Died	Labourer	Well	Nov. 15, 1858	Situation low; house one-eighth of a mile from river; clean; not crowded; one of two adjacent cottages standing alone. Several of the family had slight sore throat at the same time. At school at Throop where disease was prevailing.
	Cossor -	—	—	—	- -	Labourer	Well	Aug. 2, 1859	Wife had sore throat when the Vatters were ill; husband ailing at present, but at work. Reside next door to Vatters.
HOLDENHURST *Banks Farm*	Butler	10 — — —	4 — — —	16 11 7 —	Died; ill a week Died Died Died	Dairyman	Well	Oct. 31, 1858	Situation low, a quarter of a mile from river; house clean; not overcrowded. A farmyard, with much manure in it, close to house; not offensive at time of visit. Butler himself had slight sore throat, which appears to have been followed by paralysis of the hands and legs, hoarse voice, impaired vision, and difficulty in swallowing liquids. Children went to school at Throop, and were there in contact with Hunt, after whose death the first became ill.
Holdenhurst Green	Stanior -		4	Adult 24 Child 4	Recovered Recovered Recovered Recovered	Labourer	Well	Nov. 1858	Situation low; house clean. Mother took diphtheria soon after the Butlers, who live close at hand, but with whom there was no intercourse after they became ill. Sight was impaired, and voice husky, after diphtheria. Both the children had measles after diphtheria had been in the house, and before convalescence was perfectly established they took it. Farmyard close to house; contains much manure. Close to one side of house is a large, filthy pond, into which a privy discharges. A foul ditch communicates with the pond, and runs into street.
Gubbins Row	Barrow -	6 — — —	4 — — —	4 6 — —	Died Died Recovered Recovered	Tailor - - - -	Well - -	Nov. 4 Nov. 6, 1858	The children went to the same school at Throop with Hunt and the Butlers. Mother and a third child had the disease immediately after the two that died.

Woodfarm	Perry -	5	1	Years. 3	Died	Farmer	Well	June 26, 1859 Ill 3 weeks	No case in neighbourhood when child took ill; was ill three weeks. Both parents had sore throat at same time with child.
Holdenhurst Green	Marshall -	6	4	—	Recovered	Farmer	Well	June 12 to Aug. 2, 1858	First case went to school at Throop; the throat of one child is still glazy, and she is very anæmic. One case has been partially paralyzed in the legs, arms, and fingers; another has impaired vision.
Holdenhurst Green	Marshall -	13	1	—	Recovered	Farmer	Well	- -	Boy was in employment of Perry when his child was ill, and took the disease soon afterwards. No other case in house, but Mr. Marshall had a slight sore throat.
Holdenhurst Green	Fry - -	6	2	8	Died; ill 6 days	Shoemaker	Well	Nov. 1, 1858	The pond referred to under Stanior's case, with its ditch, is at the foot of Fry's garden, and twenty yards from his house; the pond and ditch stink much. Child having been absent a month for a slight ailment, but being then quite well, attended school at Throop on Monday and Tuesday, took ill on Wednesday, and died on the following Tuesday.
		—	—	34	Recovered				
Holdenhurst Green	Thomas -	6	1	2	Died; ill a week	Labourer	Well	April 16, 1859	A foul, stinking ditch close to house; situation very low, not being more than two or three feet above the level of river. Three of the children took ill on same day; the two elder sons went to the National School at Throop.
			3		Recovered			April 1859	
THROOP - -	Holloway -	5	1	5	Recovered	- -	Well	Aug. 3, 1859	A ditch at foot of garden; sometimes stinks; situation low, quarter of a mile from river.
Throop -	Cossor -	8	1	11	Recovered	Dairyman	- -	June 1859	A foul ditch not very remote from house; the girl's attack (aged eleven) was most severe; voice still hoarse; impaired vision; back of pharynx glazy. House well ventilated. and both it and adjoining premises are singularly clean.
		—	1	13	Recovered				

Residence.	Name.	No. of Persons in Family.	Cases of Diphtheria.	Ages of Sick.	Result.	Station.	Source of Water Supply.	Date.	Remarks.
Throop -	Langridge -	8	1	12	Recovered	- -	River	June 1859	House in no respect objectionable; not overcrowded; clean. The eldest girl's speech was still hoarse when I saw her in August, and her vision so impaired she could not see to read.
		—	1	10	Recovered				
		—	1	7	Recovered				
Throop - -	Troke -	4	1	—	Died	Labourer	- -	Dec. 20, 1858	Resides next door to Langridge; a stink from a pigsty opposite at the time of visit. The second child had been ill of remitting fever a month before diphtheria occurred; could not trace these cases to contagion.
		—	1	2	Died			Feb. 1, 1859	
Throop - -	Scott - -	5	1	Adult	Recovered	Labourer	- -	Aug. 2, 1859	Resides in the house next door to Langridge's, in which Troke lived when the children had diphtheria. Whole family have had sore throat.
Throop - -	Vivian -	6	1	6	Died	Labourer	Well	Jan. 16, 1859.	Both parents had sore throat at the time the children were ill; House close to river.
			1	2	Died				
			1	5	Recovered				
Throop - -	Dowdell -	6	2	—	Recovered	Farmer	- -	July 1859	There is no obvious nuisance, but the farm yard contained a good deal of manure with a small pool of stagnant water; close to river.
Throop - -	Vatcher -	3	1	16	Recovered	- -	Well	July 1859	Patient still anæmic, and exceedingly weak; pulse much depressed; tonsils enlarged, but free from exudation; glands at angles of jaw much swollen. Grandfather, aged 60, has sore throat at present.
Throop - -	Fry -	3	1	4	Died	Labourer	-	March 31st, 1859	An offensive stagnant pool at a short distance from house which is also near the river; land flat; bed room windows do not open; the privy is against the house. Child that died went to the chapel school, where there had been no case for 3 months. Mother had sore throat when child was ill.

BLACKWATER -	Troke - -	3	1	5	Died	Bastard	- -	July 23, 1859	Could discover no communication with any source of contagion. The other child escaped.
PIGSHOOT -	Roberts -	5	2	—	Recovered	- -	River	Nov. 28, 1858	Roberts and Hebditch reside in the same house, which is very close to the river; the river is full of weeds, which smell much, and render the water almost undrinkable at certain seasons, when they are decomposing.
	Hebditch -	7	1	5	Died	- -	- -	June, 1859	
		—	1	13	Recovered	- -	- -	July 4, 1859	
		—	1	3	Recovered	- -	- -		
MUSCLIFF -	Martin -	—	1	4	Died	Keeper	- -	July 15th, July 23, August 2, 1859.	Cottage clean, and free from nuisance; several other cases, and two other deaths, have occurred in Muscliffe, a pleasant clean little village close to the river, but rather more elevated than Throop or Holdenhurst.
			1	10	Died				
			1	—	Dying				
Muscliff - -	Plowman -	—	1	7	Died	Labourer	- -	Oct. 16th, 1858.	Two of the Plowmans died, but only one appears in the register. This girl was in the habit of going to the Boyle's at Redhill, and took ill about a fortnight after Boyle.
REDHILL -	Boyle -	5	1	6	Died	Labourer	Well	Oct. 9, Oct. 1858.	Redhill elevated, dry, well-placed, free from obvious nuisances, and remote from the river. Had intercourse with Hunt's child both before and during its illness. First case took ill 14 days after Hunt; survived 14 days, and then died. House clean and well kept.
			1	—	Recovered				
Redhill - -	Hunt -	—	1	12	Died	Brick-burner	- -	Septr. 11, 1858.	This was the first case in the neighbourhood. The child came home from Bournemouth, where it is alleged diphtheria existed, on the Sunday, and took ill on the following Wednesday. The Hunts have finally removed to Bournemouth, and on inquiry of Mrs. Hunt I learnt that the only house excepting their own in which the child had been was that of a laundress, where there was no diphtheria. The child had been wet through on the Sunday morning, and returned with wet feet to Redhill. The supposed importation of the disease from Bournemouth to Redhill by Hunt is not at all supported by the evidence.
CHARMINSTER	Dutton -	8	1	Adult	Recovered	Squatter	Spring; at bottom of hill tastes of peat.	July 1859	Father has had diphtheria severely; six children have had sore throats; tonsils are still enlarged and red. Charminster elevated on a hillside, and on dry soil, and is free from all nuisances.

Residence.	Name.	No. of Persons in Family.	Cases of Diphtheria.	Ages of Sick.	Result.	Station.	Source of Water Supply.	Date.	Remarks.
				Years					
CHARMINSTER—*continued.*	Vine -	7	3	—	Recovered	Squatter	Well	July 1859	One case was very severe; the others mild; of the two remaining children who escaped one slept with one of the sick children.
	Oliver -	11	5	—	Recovered	Squatter	Well	do.	
	Shirley -	5	4	—	Recovered	Squatter	Well	Jan. 1859	House somewhat distant from the others; in a bottom, but free from nuisances and from dampness. Two of these children had a rash, which remained out two or three days. The other two had no rash. A daughter's child, living on the other side of the hill, a mile and a half hence, had diphtheria, and died on the 18th of January, about the same time the disease was here.
STROUDEN -	Stricklen* -	7	1 1 1	8 11 —	Died Died Recovered	Labourer	Well	March 15, June 9th 1859.	Less elevated than Charminster, from which it is distant a mile or more, but is dry, comparatively elevated, and free from all nuisances. The people are well off, the house, &c., being their own property. House strikingly neat and well kept, as are all the out-offices. The house stands alone, at a distance from other dwellings. The children went to the national school at Throop with the Vivians and other children that died, but there had been an interval of a month between the death of the first Stricklen and the previous fatal case in the same district.
BOURNEMOUTH	Panton -	—	1	12	Died	Brewer	-	Oct. 12, 1858.	The child had been from fourteen to twenty-one days at Bournemouth before it took ill, and was a week ill before its death. A child who had diphtheria came on a visit to the Pantons for change of air, when convalesent, and had been some time in the house, probably three weeks, before Panton took ill.†

* The whole of this family, seven in number, eventually died of the epidemic.

† Emily Barnes and Sarah Lodge died at Bournemouth of malignant sore throat the day before Panton, and Garrat six days afterwards. No local cause existed in Garrat's case, neither was it traceable to communication with the sick. Sore throats were prevalent in Bournemouth about the time. Jay's child and Mary Rose died on November 2d and 11th. The latter was a delicate child. No local nuisances existed to which the disease could be ascribed, neither could it be traced to communication with persons already sick f the same disease.

LINCOLNSHIRE: Spalding.—The disease prevailed generally without reference to locality, and in well-ventilated, good houses, as well as in ill-conditioned or overcrowded dwellings. The worst cases seen by Dr. Morris were in a large, well-constructed house. Among the earliest seen by Mr. Ball was a group of 19 cases, 5 of which proved fatal, in the same house, each room of which was occupied by a separate family; but this was not more in proportion to the number of inmates than often occurred in houses of a better class. The same description applies to Pinchbeck; but at Moulton the epidemic appears to have been more limited, having occurred exclusively among the poorer classes, but by no means exclusively in overcrowded houses, or in connexion with offensive drainage or other kind of uncleanliness. The medical men were unanimous in asserting that the liability to the disease was unconnected with local sanitary defects, and such of them as have patients among the more affluent classes agreed in saying that they enjoyed no immunity. Dr. Capron considered the proximity of water as having influenced the mortality, and says that, with the exception of one group of four deaths, the fatal cases all occurred either near the river bank or near standing water. Persons of all ages were liable to the disease, but children and young persons up to the age of 18 years were the chief sufferers. Infants under the age of one year very rarely indeed took the disease, and although cases occurred to persons past middle life, it was rather exceptional for adults to suffer from the disease in its fully-developed form, attended by exudation. Many of the patients had previously had scarlet fever. The following cases show that the pre-existence of scarlet fever gave no immunity from diphtheria. Eight members of a gentleman's family in Spalding had severe diphtheria in succession between the 30th of October and the end of November 1858. Two children escaped on that occasion, one of them being sent into the country for the purpose of being removed from the focus of the disease. The child in the country then contracted scarlet fever, which it communicated to its brother. From seven to eight weeks after the perfect recovery of the latter from scarlet fever it contracted diphtheria. The three eldest children had also had scarlet fever previous to diphtheria, but the interval between the two diseases was much longer. I was able also to authenticate in Spalding the case of a little girl who had diphtheria in November 1858, and afterwards scarlet fever about the middle of the following February.

Coningsby.—The disease prevailed in every situation and in every kind of habitation. It was even more prevalent among the more affluent and trading classes than among the very poor. Children between the ages of 5 and 15 years were the principal sufferers; no child under two years of age was attacked, and only a few adults. One house in which three fatal cases occurred was near to a foul ditch, from which, however, no perceptible effluvia proceeded. Tattershall Thorpe, where the outbreak of scarlet fever and diphtheria hereafter related took place, was free from obvious sanitary defects at the time of my visit. The houses were, without

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exception, remarkably clean; there was no stagnant water in the neighbourhood, and there were neither manure heaps, pigstyes, nor privies near to the dwellings. Although it was said that several minor nuisances had been removed, it was evident the hamlet was habitually in a better sanitary condition than is at all common The houses were none of them overcrowded, or built back to back, were at least ordinarily well ventilated, and the inhabitants were said to be in comfortable circumstances, and able to pay a surgeon for his attendance. None of the cases seen were paupers.

WARWICKSHIRE: Birmingham.—Elevation, dryness, or dampness of situation do not appear to have materially influenced the liability to diphtheria in Birmingham. Two good observers, Dr. Heslop and Mr. West, however, considered the disease as both more prevalent and more fatal in low-lying damp situations; and some remarkable examples of the coincidence of diphtheria with a damp dwelling were quoted. Thus two cases seen by Dr. Heslop in dry and elevated situations occurred in recently finished houses. A third case occurred in his own house, a servant having taken diphtheria in September 1857, at a time when, from some alterations being in progress, the cellar was flooded. A similar circumstance occurred to Mr. Schofield of Highgate. From some disturbance in the drainage the cellar of his house became flooded in March 1858. Whilst the water was there Mr. Schofield himself took erysipelas, and a few days afterwards a maid servant took diphtheria, of which she died. On the other hand, Dr. Fletcher mentioned having had three fatal cases among the children of a gentleman residing in a well-drained well-conditioned house, in a dry, elevated, and salubrious situation five miles from Birmingham. The house was not overcrowded, and was free from uncleanliness or nuisances. Another patient of Dr. Fletcher's, a manufacturer living in an excellent house, lost two out of three members of his family who were attacked by diphtheria. Dr. Heslop, Dr. Wade, Mr. West, and Dr. Fleming considered, that although overcrowding of houses and defective drainage, or local uncleanliness, were not causes of the disease, yet they aggravated it, and that persons placed under such circumstances were less likely to recover. But these opinions were not established by such facts as satisfied me there had been any uniform relation between the presence of such conditions and fatal diphtheria; and Dr. Heslop said he had seen several cases under circumstances singularly opposed to them. A few instances of young infants having had diphtheria were related. One was mentioned in which an infant aged three months coughed up a membranous cast. The case was accompanied by croupy symptoms and convulsions. The greater number of cases were those of children who had passed their second and not exceeded their twelfth or thirteenth birthday; but adults were by no means exempt. Typhoid fever had been prevalent previous to the occurrence of diphtheria, and the latter very often appeared in the same situation; this, however, appeared to be only a coincidence. The delicate and the strumous were alleged to be the

most susceptible of diphtheria, but the robust were not entirely exempt. Privation did not appear to predispose to the epidemic, and a previous attack of scarlet fever secured no immunity. Cases were mentioned of persons who had previously suffered from scarlet fever being at a subsequent period attacked by diphtheria.

The greater proportion of the cases at Erdington occurred in the worst portion of the district, near the pool, and on the banks of the Tame. When the pool was refilled with water the disease, it it said, disappeared from that neighbourhood. At Bromford, near she river, the epidemic long continued to linger, and cases were especially observed to occur with an easterly wind. At first the disease was confined to the lower and damper situations, but by-and-by it crept into the more elevated district, where it attacked the wealthier classes residing in well-conditioned houses, among whom it proved quite as unmanageable as among the poorer residents in worse houses and localities. The majority of the cases were those of children between 3 and 10 years of age. Few adults and no children under 2 years of age were attacked. Some of the cases were those of persons who had previously had scarlet fever; others had not had scarlet fever.

Diphtheria prevailed at Water Orton in dry and elevated districts, and in the best as well as the worst class of houses; but the drainage is most defective, and most of the cases were in the immediate vicinity of offensive pools or open drains, receiving farmyard or privy drainage. Two very severe but not fatal cases occurred to the children, aged 12 and 16 years respectively, of the town clerk of Birmingham. The cellars of the house were at the time, and had been for some months, flooded with water from the roof, in so offensive a state that the smell pervaded the lower rooms.

Diphtheria prevailed at Edgbaston, both in high and dry situations and also near the canal, but manifested no particular preference for either. It occurred mostly in well-constructed houses, in which there was neither uncleanliness, overcrowding, nor defective drainage, and among persons in comfortable circumstances. Persons between the ages of 4 and 18 years were the most liable to suffer from the epidemic.

At Highgate diphtheria was pretty equally distributed in low-lying and more elevated places, in proportion to the number of their inhabitants. The earlier cases were almost all either in damp, newly-erected, or ill-drained houses; but the later cases occurred indiscriminately in the best and worst conditioned dwellings. Of personal circumstances, that of age alone appeared to have any influence, the great majority of the attacks having occurred to young persons past the age of early infancy and below that of puberty.

The cases at Sutton Coldfield occurred chiefly in ill-ventilated, overcrowded houses, but there were bad cases in good houses. Many cases are said to have occurred among the Irish. Children from 3 to 16 or 17 years of age were the most liable. One case occurred in a man aged 27 years. Strumous persons, and such as were

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previously liable to sore throats, suffered largely. None of the patients were very poor, and most, if not all, the cases at Sutton Coldfield occurred in dry and airy situations.

Henley-in-Arden.—The largest number of the cases, and the severest, occurred in the dry and airy parts of the district, and 15 of the worst cases were in thoroughly well-constructed, well-drained, and well kept houses. Most of the cases were in persons enjoying affluence, or at least in comfortable circumstances. No difference of susceptibility was observed to exist between persons who had, and persons who had not previously had scarlet fever.

WORCESTERSHIRE: Dudley.—Five cases occurred in well-built, well-kept houses, but there were most offensive nuisances in their immediate neighbourhood. The sixth fatal case occurred in one of the best situated, best constructed houses in the town. In reference to the first-named cases, it is but fitting to say that houses exposed to offensive nuisances tainting the air with the effluvia from decomposing excrement or pigsties, form the great majority of the houses of Dudley, and that the small prevalence of diphtheria in that town is adverse rather than favourable to the supposition that such local nuisances have any influence either in producing or aggravating the epidemic. Four of the patients were in easy circumstances, and the others far above privation.

Redditch.—The attacks on the gravelly side of the town were very few, and there were no fatal cases; on the clay side of the town little difference was observed in the prevalence of the disease in the low-lying or higher parts. Neither did the epidemic show a marked preference for one class of dwellings rather than another, but attacked indiscriminately persons residing in every description of house. The inmates of a row of 30 houses, near to which was a very foul drain, among whom it had been supposed the disease was sure to appear, entirely escaped.

STAFFORDSHIRE: Wolverhampton.—Dr. Topham says the epidemic was worst in the ill-drained, damp parts of the town, but that it attacked persons of all ranks indiscriminately. The late Mr. Edwardes, whose opportunities of observation were good, wrote that, although the disease prevailed most among the lower orders residing in unhealthy situations, yet the higher classes living in good houses and healthy localities were by no means exempt, and this appears to have been the general experience of the profession in Wolverhampton. As in other places, the major part of the persons attacked by the epidemic were children. In one cottage at Penn, which I visited, there had been a fatal case, and a second case was in a doubtful state at the time of my visit. The cottage was small, but neither overcrowded nor exposed to any malarious or miasmatic exhalations. Severe cases occurred in a good farmhouse at Penn. They were well marked cases, for I saw some of them still suffering from the impaired vision and peculiar aphonia so common as sequelæ of this disease. The house was clean; not overcrowded; stands in an elevated situation

and has no very obvious nuisance sufficiently near to affect its inmates; the soil is clay. The farmyard and outbuildings are on one side of the garden, in front of the house, and an ill-constructed drain from them passes through the garden, 15 or 20 yards from the house, and conveys the drainage into a field on the other side of the house, but to a point sufficiently distant to be perfectly innocuous. After a careful examination, I was unable to point out any local circumstance likely to have been connected with the outbreak. The patients in this house had all had scarlet fever a few years previously; and a second group of cases, three of which were fatal, that were investigated in connexion with the cases at Penn, had all had scarlet fever in an unequivocal form within a year of having diphtheria, but yet with an interval of so many months as to ensure their perfect recovery from the one disease before they took the other.

West Bromwich.—Two of the cases were in good, airy, well-drained houses; the two fatal cases were in a low-lying, damp, and uncomfortable cottage.

Leek.—The earliest cases in the neighbourhood were in an isolated house on the hills, some miles from the town, where four or five of the family died of the disease. Cases have occurred in all parts of the town and neighbourhood, in high as well as in low situations, but perhaps the epidemic has been worst in low, damp, and confined situations. Cases occurred in very good well-kept houses, and there were a good many fatal cases in small but well-conditioned houses; but the greater proportion and the worst cases occurred in overcrowded, ill-ventilated houses; and, especially where the atmosphere was impure, or the drainage defective. Prevailed chiefly among the working classes, but not a few, bad, and fatal cases occurred in affluent families. The disease was almost, but not quite, confined to the ages of childhood and youth. There had not been a single case in the workhouse, which is healthily situated outside of the town, and said to be well arranged, at the time of my visit, in the spring of 1859. Diphtheria occurred to persons who had previously had scarlet fever, of which the following case is an example:—A. B., female, aged 13, had scarlet fever severely in a house five miles from Leek. Six weeks after her perfect recovery she returned home to Leek, where diphtheria was prevaling. A fortnight after her return scarlet fever broke out in the house, and four of her brothers and sisters had it severely, but all recovered. Whilst they were ill, A.B. took diphtheria, of which disease she died.

CHESHIRE; Nantwich.—Diphtheria prevailed both in damp and dry situations, but appears to have been the most prevalent in damp situations and on clay soil, which was, however, said to be well drained. The greater number of cases were among cottagers, and the disease was in a few instances coincident with offensive drainage, or with local uncleanliness, but it also occurred in well-conditioned and not overcrowded dwellings, among persons far removed from privation. Children between the ages of

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2 and 12 years were the principal victims, but one child aged one year had the disease; two of the fatal cases were aged 18 and 23 years respectively, and a few adults of more advanced age were attacked.

NORFOLK; Cromer.—The district is altogether dry and airy, and no cases occurred in the vicinity of the ague cases already referred to. Cases occurred in every kind of house; in well-constructed, well-ventilated, and not overcrowded houses, as well as in ill-conditioned dwellings. Diphtheria was sometimes coincident with local causes of atmospheric impurity, and was perhaps more fatal under such circumstances. Some of the fatal cases occurred in houses where there had been much previous sickness. The affluent classes were by no means exempt, neither were such persons as had previously had scarlet fever.

North Walsham.—The disease prevailed equally in high and dry as in low and damp situations. It was very prevalent and severe in Trimingham, a very high parish, and in Southrepp, an adjoining but very low and marshy parish. In the latter there were more cases in proportion to the population in the lower portion near the fen than in the higher portion of the parish, but the epidemic was upon the whole worse in Trimingham than in Southrepp. Cases occurred in all kinds of houses and among all classes of society. The earliest cases were the child of a banker, aged 9 years; the son of a solicitor, aged 18 years; and the daughter of a butcher, aged 20 years; but the greater number of cases have occurred in inferior houses, among the poorer class. Sometimes there were accumulations of offensive refuse near the houses, which were also sometimes overcrowded and ill-ventilated; but although it is thought by the medical men that the epidemic was more fatal in such situations, the evidence adduced in support of the opinion was not altogether conclusive.

Norwich.—Dr. Ranking reports that locality has had little influence. The worst cases he has seen were in tolerably well-ordered and well-situated labourers' cottages. He has, indeed, seen severe as well as mild cases under the most favourable hygienic and dietetic advantages.

Coltishall.—The epidemic has prevailed equally in high and in low situations. Cases occurred near the river, and also in the highest and driest part of the district. Nearly all the cases occurred in well-constructed and not overcrowded houses, free from uncleanliness or offensive effluvia, and among persons in comfortable or even affluent circumstances. As a rule, the mildest cases were among the cottagers. Children were the chief victims, and the disease was equally fatal to those who had as to those who had not previously had scarlet fever.

Stalham.—Has prevailed equally in higher and dry as in low-lying and damp situations, and chiefly upon a clay soil. It occurred equally in the best as in the worst-conditioned houses; among the affluent as among the poor; and was quite unconnected with local impurities. Mr. Clowes stated that he had tried, but

unsuccessfully, to trace some relation between diphtheria and local sanitary defects. There were more fatal cases among adults here than has been common elsewhere. One fatal case was aged 58, and others, 33, 32, and 22 years respectively. A person aged 70 years had diphtheria.

Smallburgh.—The whole district is flat, and therefore the epidemic has here prevailed exclusively in low-lying, damp, situations. Some of the severest cases were at Honing, where there are heaps of manure and ordure before the houses; but cases also occurred in better situations, particularly towards the conclusion of the epidemic, and among the more affluent classes. It attacked chiefly children from 1 to 13 or 14 years of age.

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ESSEX: Brentwood.—The greater number of cases attended by exudation occurred singly, but sometimes there was more than one case in a house. In an instance in which three cases, two of them fatal cases, occurred in the same family, there had been scarlet fever in the adjoining house a few weeks before. The children who had scarlet fever, were quite well, and in free communication with the children who afterwards had diphtheria before the latter disease showed itself.

Tolleshunt D'Arcy.—Single cases rarely occurred in households where there were children in free communication with the patient, but the disease by no means uniformly attacked all the children of a family; the robust and healthy often escaping. There was usually an interval of four or five days between successive cases in the same house. When children slept together the illness of one was commonly followed by that of the other; but with this exception the disease was not traced to communication with the sick.

Maldon.—Diphtheria very frequently, but not invariably, attacked all the children of a family in quick succession; in other cases, whilst one or two had diphtheria, the rest suffered from slight sore throat. In one instance a single case occurred among a family of seven or eight children, all in free communication with the sick one throughout his illness, and yet no other case occurred. Other cases are said to have occurred singly in the same manner. There was frequently no trace of contagion, but there was nevertheless reason to consider the disease as communicable from person to person. The nurse maid who waited on three cases in a family took the disease, and was sent home to a part of the district in which the epidemic had not hitherto shown itself, where she is supposed to have communicated the disease to a sister, who shortly afterwards had it.

Southminster.—The disease very rarely, indeed, if ever, occurred singly in families consisting of several children in communication with each other; most commonly when one case appeared under such circumstances, others followed within three or four days or a week.

Witham.—There was certainly a tendency to sore throat among

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the inmates of houses in which cases of diphtheria occurred. When other cases followed a first in the same household, there was usually only an interval of a few days. The first case in the district was not traceable to contagion.

SUFFOLK: Sudbury.—No exact information was obtained as to the history of the first two cases at Bulmer, but the next case, that of a coachman's child, was supposed to have contracted the disease in the village school from one of the two earlier cases, and the first of the next group from the coachman's child, with whom there was free intercourse. There was an interval of about a week between the several cases. The disease appears most conclusively to have been imported into the house at Foxearth from Witham, where diphtheria broke out in a ladies' boarding school, and proved fatal to one of the pupils. The pupils were dispersed in consequence of the sickness, and one of them, who had suffered from the disease, but was considered as convalescent, returned home to Foxearth. At the time of her return she was still ailing; she was voiceless; the tonsils were swollen, and the posterior fauces congested; there was intense depression, and paraplegia supervened, after her return home, from which she slowly but at length perfectly recovered. She had been at home about a week, when, on June 18th, 1858, a sister aged 7 years was found to be suffering from diphtheria, and died within twenty-four hours of being seen. On the 19th of June another young lady, aged 17 years, likewise took ill, and died in three days. Four other cases of sore throat with swollen tonsils, and two of them attended by specks of exudation, occurred about the same time. On the 29th of June the family removed to Lowestoft, where it is alleged diphtheria did not at that time exist, and soon after their arrival two other fatal cases occurred. Diphtheria did not exist in the neighbourhood at the time, and was at Foxearth confined to this house.

Lowestoft.—The cases in Lowestoft have been in groups. Two of the fatal cases were the two persons from Sudbury mentioned in the last paragraph, who were ailing when they arrived. The disease has manifested a singular tendency to linger and to re-appear from time to time in the row of houses in which these deaths occurred, and the second set of cases was in the next house to the family from Sudbury. There were also mild cases in several of the other houses in the row. The disease at Gisleham appeared to originate in the parish, and could not be traced to communication with an infected place.

DERBYSHIRE: Wirksworth and Derby.—Either cases of diphtheria or of sore throat generally followed among the other children of a family where one case of diphtheria had occurred. The same remark applies to Derby, where, although single cases sometimes occurred in houses where there were other children in free communication with the sick, it generally happened that a first case was followed by others in the same household. The introduction of diphtheria into Derby was not traced to communication with an infected place.

GLOUCESTERSHIRE : Dursley.—Single cases in households where other children were in free communication with the sick rarely occurred, very often, where one or two members of a family had diphtheria attended by exudation, the others had only simple sore throat. The epidemic was most prevalent at Cam; eleven children in one house were all suffering from diphtheria or simple sore throat when I was there, and I saw in another house, 16 or 17 cases, brought from a cluster of two or three neighbouring houses. In none of these cases was there exudation upon the throat at the time I examined them, but several were said to have had it at an earlier period. Exclusive of the above, I saw upwards of 30 cases belonging to Cam, the greater part of whom either had exudation in the throat when I saw them, or were convalescent, the exudation having disappeared. Mr. Leonard, the surgeon in whose practice most of the cases I saw occurred, was at the time suffering from ophthalmia, which he attributed to inoculation, from the patients coughing up the secretion and shreds of false membrane whilst he was touching their throats with a solution of lunar caustic.

HAMPSHIRE : Christchurch.—Single cases rarely, if ever, occurred in households where there were other children in free communication with the sick. The first fatal case, that of a girl named Sarah Hunt, was at Redhill. The girl had been for some hours wet-shod three days before the attack, and was reported to have contracted the disease at Bournemouth; an allegation which the facts ascertained by a careful investigation at Bournemouth, and from the parents of the girl, failed to substantiate. It was also said by her mother that other cases in the next parish were contemporaneous with her daughters, who lived within a very short distance of the boundary between the parishes, and very near to the alleged cases. The second case, George Boyte, resided in a cottage not far from the Hunts, and had been in close communication with Sarah Hunt during her illness. The third fatal case, that of a girl named Plowman, also became ill at Redhill, and had been in constant intercourse with Boyte. Sarah Hunt attened a school attached to a dissenters' chapel at Throop, and her illness began in the school with vomiting. The next cases were those of children attending the same school with Hunt. There was an interval of about 14 days between Hunt's illness and Boyte's. From this time it would be difficult, perhaps impossible, to trace the progress of the disease, but a great majority of the cases were those of children, or of persons in immediate communication with children, who attended either at the school in which Hunt was taken ill, or in a national school at Throop, attended by 40 children, seven of whom died of the disease. Eleven or twelve children who attended the same school with Hunt died of the disease. In several cases when a child from one of the schools took ill its illness was followed by that of other members of the family who had not been at the school. Some of the cases were attended by red rash, which would seem to indicate that scarlet fever was intermingled with

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diphtheria; but the peculiar sequelæ which followed some of the cases, the symptoms of those which I saw, and the occurrence of diphtheria after measles in two cases, ill when I was there, satisfied me that many of the cases had been purely cases of diphtheria, and that probably diphtheria was associated with scarlet fever in the cases which were attended by eruption. Mr. Welch of Christchurch had two cases in children from Bournemouth. One of them, a boy aged 13 years, had been staying in a house at Bournemouth when a fatal case occurred. Soon after his return to Christchurch he also took the disease, and at a time when it was said there was no diphtheria in Christchurch. The other case was that of a boy who lived at Wick, and took ill within a day or two after his return from Bournemouth, where the disease existed at the time of his visit, A second case occurred in the same family within a day or two. The remaining children were then sent away, and entirely escaped. A very plausible account was given of the importation of the disease into Bournemouth by a family from Dorsetshire; but no evidence was afforded which would suffice to connect the outbreak either in Christchurch or Bournemouth distinctly with the supposed focus. The cases in Milton attended by Mr. Goddard of Christchurch could not be traced; but three cases at Buckley, under the care of the same practitioner, had been on a visit to a relation at Milton, whose servant was taken with diphtheria whilst they were in the house. On their return to Buckley, one of the children almost immediately took ill of diphtheria, and the others in quick succession; one of the cases was fatal. Another case, attended by Mr. Goddard, was that of a young lady in the town of Christchurch, who had just come from Bournemouth.

LINCOLNSHIRE: Spalding.—Cases sometimes occurred singly in households where there were other children in free communication with the patient, but more frequently, when one member of a family had diphtheria, the rest also, in turn, either had the same disease or sore throat. The interval between successive cases in the same house was very variable. Most commonly they occurred in quick succession, but sometimes there was a considerable interval. The disease could rarely be traced to a contagious origin, and appeared to spring up spontaneously in the district; but still cases occurred which seemed to arise from communication with the sick. Mr. Balls mentioned the case of a boy who took ill after visiting a companion sick with diphtheria. A third child who visited the second likewise took the disease. A young lady taught a child, just falling sick with a very severe attack of diphtheria, in a Sunday school, on Sunday, October 12. The young lady herself became ill of the same disease in the course of the week, and, four or five days afterwards, the maid who attended her. Other cases followed in succession in the family, but after a longer interval. A maid on a visit in Spalding with her mistress took diphtheria. The housemaid, who attended her, took ill of the same disease on the fifth day. The other servants of a large establishment

were kept from intercourse with the sick, and no further cases occurred in the house. No case of communication of the disease by means of the secretions from the throat was observed; but Dr. Morris, twice during the epidemic, suffered from ophthalmia, which he attributed to his attendance on severe cases of diphtheria, possibly to inoculation with matters forcibly expelled from the throat by coughing whilst he was in the act of sponging it. On the other hand, Dr. Capron says that he very often received in his face a discharge of saliva and secretion from the throats of his patients when in the act of sponging them, but that he never received any harm from it.

Coningsby.—Several single cases have occurred here. In one instance the child of a gentleman died rapidly of diphtheria, whilst the remaining five children altogether escaped the disease. Three weeks afterwards the son of a labourer residing at the same place took diphtheria, whilst another child in the same cottage escaped. The governess in the gentleman's family previously referred to was absent when the child died, and remained away until all danger was supposed to be past. Two or three weeks after her return she also took the disease. One of the first cases, if not the very first in Coningsby, was that of a farm labourer, who came to this parish from Langrick, distant five miles from Coningsby, in May 1858. He was suffering from sore throat at the time of his arrival, and presently became very ill of diphtheria. Whether diphtheria was prevailing at Langrick at the time of his departure is not certainly known, but it has prevailed there since in a very severe form. The labourer was considered convalescent on May 28, and on June 3, his brother, aged eight years, who had been ill three days, but was out of doors on the evening of the 2d, died of diphtheria. Two other cases followed in the same house. In April 1859, a little girl, named Chapman, aged four years, who had recently returned from Mareham to a hamlet at some distance from Coningsby, took diphtheria and died. The house in which the child lived was an isolated and in many respects well-situated farmhouse, but the premises were dirty. The farmyard is close to the house, and about 100 yards from it is an open, almost stagnant ditch for draining the land. The little girl had previously had an attack of diphtheria at Mareham, shortly before Christmas, from which she was perfectly well prior to the second attack in April. This child died on April 25, being the first case that had occurred in the hamlet. On the 2d of May, a servant maid, named White, who lived in the same house, was seized with diphtheria. Being then convalescent, she left her place on May 15th, visited her parents, who lived at the hamlet of Tattershall Thorpe, where no cases of diphtheria had hitherto occurred, staid at least one night in their cottage, and then went into service, near her parents' residence. She here suffered from a relapse or exacerbation of diphtheria; the membranous exudation reappeared in her throat, and she again came under the care of Mr. Lambden. Shortly afterwards a younger sister, who lived with the parents, became ill of diphtheria, uncomplicated either

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with scarlatina or measles. Both these cases recovered. About the 14th of June a brother, aged three years, was taken with diphtheria complicated with scarlet fever, and a severe epidemic of the conjoint diseases immediately followed in the hamlet. Neither the girl, White, nor her sister, had any of the symptoms of scarlet fever, which was unknown in the hamlet at the time of their illness, but was prevailing at Horncastle, from whence it was most probably imported, there being frequent communication between the places. On May 3d, a brother of the child Chapman, aged 20 years, was taken ill with a severe attack of diphtheria, from which he only recovered after a very tedious convalescence. To complete the history of this group of cases, a man servant residing in the house into which the maid servant White had entered as a servant, after leaving the Chapmans came under the care of Mr. Lambden for inflammatory sore throat, unattended by diphtheric exudation. Another case, which has the appearance of being derived from contagion, occurred in the house of a substantial farmer, who has two houses, one in the parish of Coningsby, the other at the distance of 10 miles. The family was divided between the two the time of the occurrence, and several cases of diphtheria had taken place in the remoter dwelling, but none in that at Coningsby, where a child, brought to the latter place from the former, about the month of April 1858, took diphtheria, but recovered. Shortly afterwards another child who had not left the Coningsby residence also took the disease, and died. These were pure uncomplicated cases of diphtheria.

WARWICKSHIRE: Birmingham.—It rarely happened that diphtheria occurred singly in households where there were children in free communication with the sick, and if the other children of a family did not have diphtheria they usually had sore throat. Cases in the same household usually followed each other in quick succession. Dr. Heslop says, "I was struck with the "general simultaneity of the outbreak in houses, and the interval "between cases always appeared to be but a very few days." Dr. Heslop says his first case, in August 1856, was before anything had been said of the existence of diphtheria in the neighbourhood. His second case, a fortnight later, was at the other extremity of the town. The surgeon with whom he saw it informed him he had seen several bad cases of similar sore throat in the same neighbourhood. The disease was not generally traced to communication with a sick person, but all, or nearly all, the medical men who have had experience of the disease consider it as contagious. Mr. West says the majority of his cases could not be traced to any direct communication with the sick, but that communication with persons suffering from scarlet fever could certainly be traced in a few cases. Dr. Wade's first case was imported from Sutton Coldfield about June 1857. Within a day or two two other children residing in the same house suffered from specky sore throat. Dr. Wade related the case of a medical man who appeared to take the contagion home from a *post-mortem*

examination. His wife was soon afterwards seized with fever and sore throat, he himself became ill next, and eventually two servants and one child also became ill. Mr. West says that he often suspected the disease to be engendered by inoculation; and that whilst frequent ablution and absolute cleanliness appeared to convey a marked immunity from the disease, diphtheria soon spread, in houses where the same feeding utensils and the same napkins were used indiscriminately for the healthy and diseased. Dr. Heslop considered previous good health as the cause of safety in persons who remained free from diphtheria, although in communication with the sick, having remarked that the disease usually attacked persons who had been predisposed by antecedent ill-health. Mr. Schofield considers diphtheria as communicable, but has often been surprised that the persons in immediate attendance on the sick have not, so far as he is aware, taken the disease. Has often seen mothers kiss their children, without injury, in an advanced stage of the disease, when the discharge from the nose and mouth was profuse, and the breath fœtid to a most horrible degree.

Diphtheria was supposed to have been imported into a ladies' boarding-school at Sutton Coldfield, by a day boarder, in whose family diphtheria was prevailing at the time. Five cases, all of them attended by the characteristic exudation, and one of them most severe, occurred. The severe case was removed home, a distance of 40 miles, when convalescent, and is supposed to have conveyed the disease to her family, two of the children and one servant having died of diphtheria subsequently to her arrival. Mr. Chavasse related a case of diphtheria characterized by the usual membranous exudation, which had neither the rash, nor the character of tongue, nor was followed by the desquamation, of scarlet fever, which occurred in a house simultaneously with two well-marked cases of scarlet fever. The patient had not previously had scarlet fever. Three instances occurred to Mr. H. S. Chavasse in which there were single cases in families where other children were in free communication with the patient. In one of these cases he found the healthy children hanging over and kissing the patient, yet the others escaped.

Henley-in-Arden.—In one family, under Dr. Ager's care, all the inmates of a house, adults included, save one, suffered from diphtheria, and he was suffering at the time from gout. The interval between successive cases in the same household was usually from ten days to a fortnight.

WORCESTERSHIRE: Dudley.—In two of Mr. Houghton's cases there were other children in the house, without any means of efficient separation, and yet no second case occurred.

Redditch.—The following cases occurred in the practice of Dr. Nicholson:—I. F., female, aged 17 years, of weak strumous habit, was attacked with diphtheria, and continued ill for 21 days. Family, consisting of parents, one son aged 19, two daughters aged 15 and 11 years respectively, communicated freely with the

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patient. One daughter slept in the same room with the patient. No other member of the family suffered. Circumstances good.

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E. M., female, aged 18 years, lived with parents in a low damp neighbourhood. Of good constitution, and generally healthy. The children of the family to the number of nine, ranging from 7 up to 21 years of age, had free communication with the patient, but no other member of the family was attacked. Circumstances indifferent.

E. H., Male, aged 4 years, living on high ground, soil marl, house damp. The family, consisting of the parents and 3 other children, aged 2, 5½, and 7 years respectively, had constant free communication with the patient, yet no other member was attacked. Circumstances bad, the necessaries of life being sometimes deficient.

Many other cases occurred in which one or two members of a family were attacked, the remainder being exempt. On the other hand, there were instances in which several members of a family had the disease in turn.

In the next house to the above, E. M., the father and the whole of the children to the number of seven, were attacked in succession at intervals varying from 12 to 48 hours. The mother was exempt. The house was damp, and there was no drainage. The family was subject to strumous complaints. Circumstances bad.

In the house of a wealthy manufacturer, well constructed and well drained, but lying low, close to a large wood, and on clay soil, the children, three females and one male, aged, 3, 5, 8 and 10 years respectively were attacked by diphtheria, two of them simultaneously, the others at intervals of a few hours. The parents remained free, but the governess and nurse suffered; the one from a mild attack of sore throat, the other from erysipelas. The case of erysipelas occurred in this house, previous to diphtheria.

Erysipelas was very prevalent throughout the town at the time diphtheria prevailed, and from the common habit of visiting the sick there is no doubt that frequent communication must have taken place, between persons suffering from erysipelas and others who afterwards had diphtheria, but no distinct cases have been recorded.

The following case is reported by Mr. Smith:—A boy aged 10 years, living in the same house with his parents and three other children, had diphtheria in a very severe form, and died from asthenia. His was an entirely isolated case, no other having occurred either previously or subsequently in the same neighbourhood.

STAFFORDSHIRE: Wolverhampton.—The following, cases occurred in the practice of Mr. Coleman. M. Hill, aged 19 years, a plethoric robust woman living at Bradmore, had diphtheria, attended by great difficulty of breathing and speaking, which were relieved after the rejection of a tough membrane. Several persons, including two or three children, lived in the same house, and all escaped. W. Norwood, aged 10 years, a tall, thin delicate lad, had

diphtheria, and also brought up a cast of the pharynx. There were other children in the same house, one only of whom had slight sore throat. The rest escaped. In a third case, an infant, aged 8 months, had diphtheria, from which it appeared to recover, but died ten days afterwards of pneumonia. The father, mother, and seven other children residing in the house all escaped. Mr. Colman had diphtheria himself, which he attributed to inoculation whilst looking into the throat of a patient.

A group of cases which I investigated at Penn were supposed to have originated from communication with the mother of a child which had died of the disease in the immediate neighbourhood. The case was by no means clearly established, but the servant of the family in which these cases occurred was allowed to go to her father's when convalescent from diphtheria. The disease did not, it was said, exist in the neighbourhood of her father's residence at the time, but was more or less prevalent in the surrounding country. A few days after the arrival of the young woman at her father's two of her brothers and a sister were taken with diphtheria which proved fatal to all three.

Leek.—Single cases have occasionally occurred in families where there were other children in communication with the sick, but they have been exceptional. More commonly, when one child has had diphtheria the rest have in turn either suffered from the same disease or from a simpler form of sore throat. The following cases illustrative of the latter statement occurred in the practice of Mr. Cooper :—A family of eight children were all successively seized with diptheria, which proved fatal to two of them. In a family of six children, four, being all that slept at home, were seized with the disease. Three of the four died of it. A family consisting of five children were all attacked, and three of them died of the disease. Another family, also consisting of five children, were all taken ill with diphtheria, and all recovered. A. B., female, aged 13 years, had scarlet fever in a house five miles distant from Leek. The attack was severe, but she perfectly recovered from it, and returned to Leek, six weeks after she was considered as quite well. A fortnight after her return, scarlet fever appeared in the house, and four of her brothers and sisters took it. Whilst they were ill, A. B. took diphtheria which proved fatal. Successive cases generally followed each other quickly in the same household.

CHESHIRE: Nantwich.—Single cases sometimes occurred in families where there were other children, but precautions were taken to prevent the disease from spreading. In the majority of instances there were several cases in a family, but not always of the same severity, some of them, and especially the mothers and attendants, having only simple sore throat.

NORFOLK; Cromer.—Single cases in families of several children were rare, and when they occurred might be attributed to the adoption of suitable precautions to prevent the extension of

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the disease. More frequently, when other children were in free communication with the sick, they also had the disease, and very often, when persons in contact with the patient did not take diphtheria, they had a milder form of sore throat. Persons with chronic enlargement of the tonsils were especially prone to suffer in this way.

North Walsham.—Most commonly when one member of a family suffered from diphtheria the others subsequently took the disease. The epidemic seemed to spring up spontaneously, and appeared about the same time in two or three separate places. Diphtheria prevailed at the same time in the parishes of Trimingham and Trunch, the former having a clay, the latter a light soil. The parish of Girningham, which has also a light soil, is thickly populated, and lies between the two others, entirely escaped. A solitary outbreak occurred in an overcrowded cottage at Swafield. The family, consisting of nine persons, resided in a two-roomed cottage surrounded by filth. Six died of diphtheria, and the father and mother had sore throat unattended by exudation. The infant escaped. These, which were the only cases in the village, appeared to be spontaneous, and could not be traced to communication with an infected source.

Coltishall.—Single cases sometimes occurred. A single fatal case occurred among a family of five persons, including the parents. The other children having free intercourse with the patient, altogether escaped. Of four children in another family having free intercourse with each other, two escaped.

Stalham.—One member of a family consisting of six or eight persons was attacked with diphtheria; the rest of the family, although in free communication with the sick person, altogether escaped. In a second family, of eight or nine persons, two were attacked, the rest escaped. In a third family of five persons, one was attacked, the rest escaped. A girl belonging to this village, at service in Norwich, came home to see her brother, who was very ill of diphtheria. Two or three days after her return to Norwich, where diphtheria is supposed not to have existed at the time, she took the disease in a severe form, but eventually recovered.

Smallburgh.—It sometimes happened that in a family consisting of several children one only had diphtheria the rest, although in free commuuication with the sick, entirely escaping; but it also, and oftener, happened that diphtheria attacked several members of the same family in quick succession.

SYMPTOMS OF DIPHTHERIA.

SYMPTOMS OF DIPHTHERIA.*

ESSEX: Brentwood.—Epistaxis and bleeding from the tonsils were common; croupy complication did not occur. The lymphatic glands were not usually much enlarged. The premo-

* Only the more important or peculiar symptoms are reported.

nitory symptoms were slight; often the only complaint was of slight uneasiness in the throat. The most prominent symptom was extreme prostration.

Tolleshunt d'Arcy.—A well-marked eruption appeared on the fourth day in three cases. One of them died twenty-four hours afterwards; in the other two cases the eruption gradually declined, and was followed by desquamation. In a few cases an attack of bronchitis followed desquamation of the skin.

Maldon.—Three forms of diphtheria were here observed, and described to me by Dr. May:—

1. A mild form, characterized by pink efflorescence over the tonsils, fauces and mouth, with a filmy deposit like gauze paper over the tonsils, unattended by much constitutional sympathy, irritation, or depression. This never degenerated into the malignant form.

2. Redness, rather more intense than in the last-described form, and with several, usually five or six, spots of yellowish exudation, which did not coalesce. This also was a manageable form, unaccompanied by alarming depression.

3. Malignant diphtheria, most rapid in its invasion and progress, and, when fatal, this usually happened from the third to the sixth day, at the earlier period of the epidemic; as late as the tenth day towards its close. In these cases there was much swelling of the tonsils; the palate was of a deep red colour; the exudation, commencing on the tonsils and pharynx, often extended upwards to the nostrils and downwards to the trachea, moulds of the latter being sometimes brought up by coughing. In one case the disease spread upwards through the nasal duct to the right eye, which was much swollen, and the palpebral conjunctiva covered with false membrane, which came away piecemeal before death. Several relapses occurred, and one case was mentioned of diphtheria in the malignant form, occurring a second time to the same patient after a six weeks' interval of perfect health. Epistaxis, and sometimes hæmorrhage from the throat, was the immediate cause of death. Depression was often either absent or inconsiderable in the early stage. Even in the severest cases patients would sit up and be playful till within a day or two of death. Convalescence was protracted, and recovery very slow. The throat often remained uncomfortable, the tonsils being large, rough, granular-looking or ragged, and the voice hoarse, for some time after an attack, especially in adults. The following case shows the delicacy of throat often left for long afterwards by diphtheria.

J. B., female, aged 13 years, had diphtheria nine or ten weeks ago, and still (March 9th, 1859) remains weak and anæmic. The throat is very susceptible to temperature, and becomes sore in raw weather. The arches of the palate are still reddish, and the posterior faces secrete a thick tenacious mucus, which clings to the membrane; the voice is raucous and nasal, and even yet, when she takes a draught of liquid, it is partially regurgitated

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through the nostrils. The sight is slightly impaired, and the gums are spongy and reddened. Another little girl, seen in the same house, continued delicate and excessively anæmic after the lapse of three months. Sloughing, by which she lost a large portion of the uvula, had followed the exudation.

Blistered surfaces always inflamed and looked angry, but were not observed to be attended by the exudation of a diphtheritic membrane. Mustard plasters often produced an efflorescence, which spread considerably beyond their margin, and, under these circumstances, the skin in their vicinity desquamated. Hæmorrhage from the nose or throat was observed to be almost invariably a fatal symptom, as was also increased swelling in the throat in the later stage. It was also an unfavourable sign when the exudation became brown or blackish in colour.

Southminster.—Fever and lassitude were here observed to be occasional forerunners of the disease. The throat was next complained of, and on examination found to be of a dark red colour, or to present some small white specks, or a larger speck of exudation, about the size of a pea. On the following day the specks were found to have coalesced, or to have extended, forming a thick whitish or slate-coloured membrane which in fatal cases eventually became brown. The brown membrane often separated at the edges, and manifested a disposition to be thrown off, but never did really separate. Epistaxis has been a rare, hæmorrhage from the throat a not uncommon consequence of diphtheria. Swelling of the glands about the jaw and neck was an occasional, not a universal symptom. Cases sometimes proved fatal as late as 14 days from the commencement of the attack; more frequently within two or three days, and several within 24 hours. Two cases were mentioned by Mr. Rush in which fatal pneumonia supervened, when the exudation had gone, and patients were supposed to be recovering. Mr. Rush had seen anasarca supervene from 14 to 21 days after diphtheria in four or five cases, which all recovered. Paralysis of the lower extremities occurred in about six cases; they also recovered. Paralysis of the organs of deglutition was a common sequel of diphtheria. One wan, whose throat, palate, and mouth, to the margin of the teeth, were coated with false membrane, which came away whole, was unable to swallow anything for some time, and nearly died of starvation in consequence. A similar case, in which the membrane also extended to the teeth, and did not come away, proved fatal. When the membrane entirely came away patients usually recovered.

SUFFOLK: Sudbury.—Cases began with slight fever, speedily followed by general exhaustion, which continued to the close. The throat at first of a dark red colour, soon became coated with the exudation, portions of which came away, leaving a florid injected surface below it. Paraplegia was observed in one instance to follow diphtheria.

Lowestoft.—In the only post-mortem examination made here

the exudation was found to extend into the trachea. Impaired vision followed diphtheria in a single instance.

DERBYSHIRE : Wirksworth.—Diphtheria was generally ushered in by rigors and vomiting, followed by fever, hoarseness, difficulty of breathing, and sore throat. On examination, either a patch of false membrame was seen upon the tonsils, or else both tonsils and the posterior fauces were covered with a leathery substance, of a dirty white colour, afterwards becoming brown in bad cases, and then attended by fœtor. Albumen has been found in the urine whenever it has been looked for, but the precise period of the disease when found was not noted by Dr. Webb, from whom I have learnt most of these particulars.

One case occurred in which meningitis came on three weeks after the urgent symptoms connected with diphtheria had disappeared. There were convulsions and coma. The patient ultimately recovered.

Deafness during convalescence has been common. Cutaneous eruption of a dusky scarlet hue, patchy, and not universal, occurred in a few cases. They were followed by desquamation, but mostly recovered. Cases in which croupy symptoms occurred generally ended fatally.

Derby.—It is stated by Mr. Harwood that a good deal of genuine croup, unattended by throat affection, occurred here at the same time with diphtheria. Deafness, attended by discharge from the ears, impaired voice and hoarseness, and anasarca have here been common sequelæ of the disease.

GLOUCESTERSHIRE: Dursley.—The greater part of the cases here were mild. In two fatal cases the disease extended up into the nares. Epistaxis has not been seen. Albumen has been found in the urine in two cases only. In one instance a child's sight was found to be impaired by its inability to read when it returned to school. In many cases the voice has been affected, and in a few liquids have been regurgitated through the nose. Mr. Williams related a fatal case at Wootton-under-Edge, in which petechiæ occurred. The same gentleman had a fatal case at Elmcote, which was attended by profuse oozing from the throat of bloody sanies, resembling claret, and amounting to two pints a day, which continued until death. Fifty-five cases of diphtheria and sore throat still under treatment, the great majority of them from the village of Cam, were examined on July 27th and 28th, 1859. Two of these, residing at Lower Cam, had diphtheria associated with scarlet fever; 21 of the remainder had sore throat, with diphtheritic exudation when seen; the remaining 32 had sore throat unaccompanied by exudation, which had either never existed or had disappeared previous to my visit. Four of the cases of diphtheria (characterised by the presence of exudation) were severe; the others were all mild. There was in most of these cases an absence of the dusky redness of fauces usually observed in diphtheria and even in the milder kind of sore throat during the present epidemic, and in several instances the mucous

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membrane, which had been covered with exudation was depressed and pallid. There was rarely any marked anæmia, and many of the patients appeared to ail but little besides the slight inconvenience arising from the sore throat. There was slight swelling of the glands at the angles of the jaw in most of the patients, and in one or two the swelling was considerable. The glands were also tender. The urine was only examined in two or three of the worst cases, but was in all of these free from albumen. Several of the cases which had no distinct exudation had portions of tenacious opaque mucus clinging either to the tonsils or to the posterior fauces. The rest were cases of simple mild tonsillitis, with but slight affection of the posterior fauces. Among the cases of genuine diphtheria was an old woman aged 65 years, and adults of the ages of 37, 32, 24, 22, and 18 years; the rest were under 18 years of age.

HAMPSHIRE: Christchurch.—The only fact worthy of special notice is the history of the following case, in which a patch of diphtheric exudation occurred upon a sore in the breast.

A.B., aged 32, wife of a labourer, came under the care of Mr. Stevens on February 10th, 1859. She had an infant 10 months old, and had been suffering for several weeks from an abscess in the left breast. She complained of stiffness in the throat, difficulty of swallowing, and pains in the ears. The tonsils, soft palate, and uvula were of a deep claret colour, but free both from ulceration and deposit; pulse 140, small and weak; skin warm and perspiring. There was no rash, and no thirst. On the left side of the left nipple was a sore the size of a shilling, from which proceeded a thin sanious discharge. Two days afterwards there was a patch of exudation on the left tonsil, which next day had spread considerably, and a similar patch had also appeared on the right side. Complained of stiffness in the left breast, the sore upon which was covered by a yellow deposit. Albumen was at no time found in the urine. She was well supported, and gradually recovered, the deposit in the sore upon the breast coming away in a poultice about the fourth or fifth day after its appearance.

LINCOLNSHIRE: Spalding.—Diphtheria was here intermingled with scarlet fever, and whilst cases both of pure diphtheria and of pure scarlet fever occurred, there were also many in which the two diseases were combined. Dr. Capron distinguishes the following varieties of sore throat as having come under his observation while at Spalding.

(1.) "Mere injection of fauces:—with generally an œdematous condition of the uvula.

(2.) "The same, with small patches of ulceration on one or both tonsils.

(3.) "Little redness, but deep excavated ulcers of one or both tonsils, accompanied with little pain, and no difficulty of swallowing or constitutional symptoms.

(4.) "Swelling and œdema of soft palate, uvula, and tonsils, rapidly followed by sloughing or gangrene, and often extending to neighbouring mucous membranes. Constitutional symptoms severe from the commencement.

(5.) "Exudation of fibrinous membrane, followed by sloughing, and attended by severe constitutional symptoms."

Diphtheria was sometimes attended by fever of remitting character, as if influenced by malarious poisoning. This was not only observed by several of the Spalding practitioners, but also by Mr. Elsdaile, of Moulton. In one case seen by Mr. Balls the disease began with bronchitis, the throat affection only appearing subsequently; the patient recovered. Sometimes, as indicated by pains and subsequent discharge from the external meatus, the disease appears to have crept along the eustachian tube, and deafness was an occasional result. It also appears sometimes to have crept down the œsophagus, three deaths having occurred after the throat affection had entirely subsided, from symptoms of gastric disorder, or perhaps perforation of the alimentary canal, a fact unfortunately not decided by post-mortem examinations. In one of these cases the patient eat imprudently after convalescence was considered as fully established. The day following he was seized with intense epigastric pain, vomiting, and collapse, and he died in 30 hours. When blisters were applied to the chest, diphtheritic exudation was sometimes formed on the excoriated surface; and I saw a case of diphtheria of the vagina in a little girl aged 18 months. She had been ill five days, but was sitting up. The tonsils and uvula were covered with the characteristic exudation, so was a small abrasion on the buttock. The pudenda were swollen and inflamed, and uniformly coated with a white membranous secretion extending over the labiæ. The membrane could be readily detached in flakes, and on lifting its edge the surface below was observed to be red and tender, but not ulcerated. There was no swelling of the glands, either in the groin or at the angles of the jaw. This patient eventually died with croupy symptoms, from the extension of the disease into the trachea. A case was mentioned by Mr. Balls in which a diphtheritic exudation commenced in the incisions which had been made to relieve some incisor teeth, and, spreading from the wounded gums to the throat, proved fatal to the patient. Many of the cases were exceedingly tedious, the disease manifesting a great tendency to assume a chronic form, and cases of severe relapse were by no means rare. I visited a man aged 28 years, residing near Pinchbeck, who had taken diphtheria in the last week of January. On March 20th, I found him very pallid and anæmic; voice thick and snuffling. There was still a white filmy patch on the arch of the palate on either side; the uvula had nearly altogether sloughed away. There was likewise a spot of white, opaque, false membrane on the posterior fauces on either side of the median line; the rest of the posterior fauces were covered with a semi-transparent filmy kind of coat; skin sweaty; pulse 72, feeble, and jerky; sight, dim; complains of numbness in the belly, and in the legs, arms, and hands, but espe-

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cially in the left arm and leg; is unable, from this cause, to dress himself; is a little giddy when in the open air; has prickling in the fingers. Three weeks ago there was puffiness of face in the morning, and œdema of feet and legs at night. Still has difficulty of swallowing; urine clear, pale coloured, free from albumen. Dr. Cammack mentioned cases in which patients continued to go about until within a few hours of death, which appeared to arise from sudden prostration. The extension of the disease downward along the œsophagus was also referred to by Mr. Stiles, who spoke of difficulty of swallowing sometimes as occurring without any evident throat affection. On passing a probang in one of these cases portions of false membrane were brought up on the sponge from some point out of sight. Diphtheria existed in the house, but the only ailment of the patient was a sensation of choking, which led him to think something was sticking in his throat, and it was under this impression that the probang was introduced. In a girl aged 10 years there was constant sickness, and tenderness of the abdomen, accompanied by the passing of flakey bits of membrane in considerable quantity from the bowels. A similar case occurred to Mr. Elsdaile of Moulton. In one case pneumonia, immediately following diphtheria, proved rapidly fatal. The following cases of sudden death when convalescence was considered far advanced were related by Mr. Stiles of Pinchbeck:—A carpenter's apprentice, having just recovered from diphtheria, went home to see his parents at a distance of three miles from his master's house. He there took a basin of bread and milk, went to bed, and died suddenly three hours afterwards.

Henry Allen, aged 10 years, after five days' illness with diphtheria, although so well as to hold Mr. Stiles's horse on the preceding evening, died on the sixth day.

A young man aged 16, in service, had been 10 or 12 days under treatment for diphtheria, and then appeared to be quite convalescent; he went home to visit his friends before resuming his duty, and there died suddenly. The following somewhat analogous case was told me by Mr. Elsdaile of Moulton. A girl aged twelve years, in whom all throat affection had disappeared, but who still had difficulty in swallowing, and loss of voice, had an attack of diarrhœa when convalescent, which did not disable her from visiting a friend; she was seized in the night with palpitation and fainting, rapidly followed by death.

Copious hæmorrhage from the bowels occurred in several cases at Horncastle.

Coningsby.—Two well-marked cases of a second attack occurred in the practice of Mr. Lambden. In one of them the first attack was in July 1858; the second, after a long interval of good health, in the following January. The other case was a little girl, of strumous and delicate habit, aged 10 years, who had a severe attack of genuine uncomplicated diphtheria in July 1858, from which she recovered very slowly; being then quite recovered, she had a second attack in October, from which she recovered more rapidly. She has now had a third attack, from which she is

also recovering slowly. In one case paralysis of the lower limbs occurred a month after diphtheria; and when the patient was well enough to walk three miles. He ultimately recovered. Children frequently went about almost to the last; one patient of Mr. Lambden's, aged 13 years, was sitting by the fire when she was visited, walked to the window to have the throat inspected, and yet was dead within two hours.

A remarkable outbreak of scarlet fever, complicated with diphtheria, occurred in the hamlet of Tattershall Thorpe, in this parish, in June 1859. It was to this hamlet that the girl White, already referred to in a former section of this paper, went, after leaving her place on May 15, and it was while here that she suffered the relapse of diphtheria, followed by the illness of a younger sister and of the man servant in her new place of residence. Measles prevailed in the neighbourhood about or soon after her arrival, and scarlet fever broke out in June. The supposed first case of the latter disease, that of a boy, was not seen by any medical practitioner. The second was a child called Sellars, upon whom, it was said, was both the rash of rubeola and of scarlet fever, and whose throat presented also the characteristic membranous exudation of diphtheria. The catarrhal symptoms which accompany measles did not exist, and the child died, without croupy symptoms, within 48 hours from being seen. Another child, aged eight years, residing in the same cottage, had diphtheria, unattended by scarlet fever, simultaneously with Sellars, and the mother was taken ill with diphtheria, also unattended by scarlet fever or measles, two or three days after the child's death. These cases were in the next cottage to that in which the girl White's parents resided. From this time scarlet fever, usually complicated with diphtheria, prevailed in the hamlet; and the following cases are reported from my own observations on the 18th and 19th of June:

1. James White, aged three years.—Has been ill four days, with mild scarlet fever. The traces of the characteristic rash still remain. Posterior fauces covered with membranous exudation; tonsils much enlarged, free from ulceration; clean, but said to have been covered with diphtheritic exudation.

2. Martha Atkins, aged two years.—Was taken with scarlet fever 14 days ago; two days after the scarlatinous rash appeared rubeolous rash also became visible; the latter was in patches, and chiefly, perhaps exclusively, on the arms. Some of the eruption was much larger than the ordinary rash of measles; there was neither coryza nor the other catarrhal symptoms which ordinarily attend measles; but this disease was prevalent in the hamlet; and cases had occurred next door shortly before the child was taken ill.

Present condition.—The skin of the hands, arms, and legs is perfectly soft and smooth, but that of the body is desquamating freely; the nostrils are red, and discharging an acrid, ichorous fluid. There is an enormous tumour on the left side of the neck which is boggy, and indistinctly fluctuating; it was opened, but discharged only bloody serum, in small quantity and scantily,

mixed with streaks of pus. The pulse is quick, thready, and feeble; the tongue has not the character of the tongue in scarlet fever. The tonsils are much enlarged, and a distinct, raggy-looking piece of white membranous exudation is hanging to the right tonsil. The uvula is partly covered with white, closely adherent exudation, and the posterior fauces, so far as they could be seen, were covered with a similar exudation, of a darker colour; there are also several distinct patches of exudation on the gums. Urine not albuminous. This child eventually died.

3. James Cunningham, aged 12, residing in the same house with No. 2.—June 19th. Is manifestly recovering from scarlet fever. The skin is desquamating; pulse 64, very compressible; tongue clean, and free from the red injected character usual after scarlet fever; tonsils much swollen, red, not ulcerated or abraded, but bled freely on being accidentally touched. There is a small but distinct patch of exudation on the left tonsil, and also a very small circular patch on the posterior fauces. Mr. Lambden reports that the tonsils were entirely covered with diphtheritic exudation.

4. John Cunningham, aged 60, residing in the same cottage with Nos. 2 and 3.—Complains of sore throat, and extreme prostration of strength; pulse feeble, and very compressible; tongue clean; throat generally inflamed; tonsils enlarged. There are one or two small white specks on each tonsil, which rather resemble enlarged follicles than diphtheritic exudation, and cannot be rubbed off. The illness began with shivering. Urine not albuminous.

5. Joseph Taylor, aged nine years.—Is recovering from scarlet fever; the skin is desquamating freely; tongue clean, slightly injected; pulse 76, very compressible; throat presents no trace of ulceration; the tonsils are much enlarged, and have one or two superficial depressions such as are sometimes seen after the separation of a diphtheric membrane, with which they, in this case, are said to have been covered; posterior fauces covered with a thick layer of dirty-looking grey stuff, adherent to the mucous membrane, but which has not exactly the ordinary appearance of exudation. Is lame in the left foot, which is swollen and hard, as if the cellular tissue were infiltrated with some firm kind of exudation; the foot where swollen is of a faint rose colour, slightly tender, and does not pit on pressure. He pricked the foot at the angle between the great and second toes with a muck fork six weeks ago; the wound healed, and the foot appeared quite well till now. The wound has re-opened; is of a pink colour; appears to be lined with a white substance, and is discharging a very small quantity of ichorous, non-purulent fluid. There is no distinct line of demarcation between the white and pink parts, and the parts are very insensible, an unsuccessful attempt to separate a portion of the white lining for examination having produced neither bleeding nor much pain.

6. Selina Taylor, aged five years.—Recovering from scarlet fever; skin desquamating freely; pulse quick, feeble; tongue

coated with a white fur; profuse diarrhœa. The tonsils have an excavated appearance, but there is neither slough nor ulceration. Both tonsils and uvula are partially covered with white, filmy membranous exudation; posterior fauces covered with a dense-looking, ash-coloured exudation.

7. Mary Ann Taylor, aged 15 years.—Convalescent from scarlet fever; skin desquamating freely; tongue clean, and not injected. There is a distinct patch of diphtheritic exudation on the right tonsil, and besides this both tonsils are partially and the posterior fauces entirely coated with semi-transparent, grey matter. There is neither pain of throat nor difficulty of swallowing.

8. Benjamin Taylor, aged 17 years. Was taken ill yesterday (June 18th). The rash of scarlet fever is appearing to-day, but less freely than it ought. Pulse 120, of fair volume, but very compressible; skin pungently hot; tongue white, dry; there is much pain in swallowing; posterior fauces red, and injected, without ulceration; tonsils much swollen. Upon the left tonsil is a patch of ash-coloured exudation, and also upon the posterior fauces. Upon the right tonsil is a large patch of viscid semi-membranous-looking secretion, loosely attached, and which on its removal left the subjacent membrane without abrasion. Urine not albuminous.

The following cases were seen in a cottage in the same hamlet:—

9. Frank Richardson, aged 5 years. Had measles, attended by the usual catarrhal symptoms, rather more than a fortnight ago. Has been ailing ever since. Is very pallid and anæmic. There is no desquamation of the skin or trace of eruption; tongue clean; nose sore, and discharging; pulse quiet, and very feeble. The tonsils are covered with a filmy membrane, and the posterior fauces with a distinct diphtheritic exudation.

10. Mr. Richardson, aged 44 years. Has not now had measles, but complains of sore throat, of debility, and of pain in the ankles; pulse quiet, feeble; the right tonsil and the posterior fauces are covered with a thin filmy membrane.

11. John Richardson, aged 21 years. In the same house with Nos. 9 and 10. Complains of sore throat, which on examination was found to be red and congested, but to have no definite diphtheritic character.

This group of cases of diphtheritic scarlet fever were unmistakeable cases of scarlet fever, in which the throat became diphtheritic very soon after, but not until the scarlatinous rash showed itself. Diphtheria, although it sometimes lasted much longer than the rash, was in each case a close attendant and not a sequel of scarlet fever. In measles, on the contrary, it appeared at a later period, after the rash had entirely and for some days disappeared.

WARWICKSHIRE: Birmingham. Diphtheria was sometimes preceded by drowsiness, feverishness, and by chilliness, but not by marked rigors. In one case the invasion was ushered in by convulsions. The feverishness soon gives way to depression.

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Dr. Heslop states, that, from careful observation, particularly of the more recent cases, he thinks a moderate enlargement of the glands near the angle of jaw, especially of the submaxillary, precedes the exudation. Vomiting is said to have sometimes preceded the attack; but it is questionable whether the alleged cases were not complicated with scarlet fever. The pulse is sometimes rapid at the outset, but occasionally becomes slower as the disease advances. Dr. Heslop states, as the result of his experience, that the febrile excitement is less than in any severe disease with which he is acquainted, the frequency of the pulse being usually little above, and sometimes considerably below, the normal standard. He once found it under 40 in a child aged 5 years, but severe hæmorrhage had preceded the visit. The signs of depression are most marked; they come on earlier and remain longer than in any other acute disease. The throat is generally complained of very early. On examination, the exudation most commonly was already present; but in cases seen at the very commencement the tonsils and pharynx were of a deep purplish red colour. The first local appearance of diphtheria, said Mr. West, was sometimes that of aphthous ulceration of the tonsils and soft palate, which soon gave place to a coating of fibrinous material. Purpura has sometimes been an attendant of diphtheria, and rash has been noticed by several observers. Sometimes the rash has resembled erythema; in other cases it has occurred in wheals; and Dr. Fletcher has observed a measly mottling of the skin; the same circumstance was observed by Mr. Elkington of Edgbaston. Dr. Heslop has not observed eruption in idiopathic diphtheria, but has been struck with the very peculiar speckled eruption, such as is described by some authors under the name of rubeola, Rötheln, and the "hybrid of scarlatina and measles," which has been prevalent during the recent epidemic of scarlet fever, and has met with diphtheria as a complication of this disease. Albumen was frequently found in the urine, but by no means always even in severe cases. Dr. Heslop looked unsuccessfully for tube-casts in one severe case attended by profuse albuminuria; and Mr. Houghton of Dudley said that he had likewise failed to discover tube-casts in a case attended by albuminuria, although carefully sought for. Besides the more usual extension of this disease to the nares, or trachea, Dr. Keyworth mentioned a case in which the disease extended to the right eye and caused sloughing: it was fatal. Death has occurred in several ways; sometimes from croupy complication; sometimes with stupor; sometimes, but more rarely, and in young children, with convulsions; sometimes from exhaustion, and then often very suddenly. Among the sequelæ observed were impaired vision; aphonia, or rather snuffling voice; loss of power in the limbs; tenderness of the surface; deafness, and this in two cases without discharge from the ears; paralysis of the muscles of deglutition, so that liquids regurgitated through the nostrils; and inflammation of the eyes. Exudation on the pudenda has been witnessed in several cases by Dr. Keyworth. The extension of the disease down the trachea, producing croupy symp-

toms, has been comparatively rare. Mr. West has never seen any marked affection of the larynx, and Dr. Heslop states that he does not think such complication has occurred in more than 5 per cent. of the cases. The animal temperature is stated by the same physician to be not ordinarily above the average of health. This opinion is based on experimental investigation with the thermometer, but the record which would have given the facts in detail was mislaid. Hæmorrhages from the throat, nose, and kidneys have been observed. In the latter case purpura always co-existed with diphtheria. In reference to prognosis, a severe nasal flow is a serious element, and the younger the child the greater the danger of death by the supervention of croup or by asthenia. Severe hæmorrhage is a bad feature, but not necessarily a fatal one. In general terms the danger is proportionate to the amount of exudation, and to its quick return after removal. A marked diminution of temperature, with mottling of the hands, is of bad augury. The subsidence of the swelling about the angles of the jaw is favourable, and usually coincides with mitigation of all the other symptoms, local and general. Relapses have sometimes occurred.

Dr. Fletcher had made one post-mortem examination; that of a boy aged 9 years. The larynx, trachea, and first ramifications of the bronchii were lined with croupy membrane, as thick as paper at the upper part, but diminishing in thickness as it descended along the air passages. The spleen was much softened; the kidneys healthy.

The following is the report of the post-mortem examination of a child aged 6 years, which died of diphtheria, under the care of Mr. Jauncey. The disease was contracted at a country place where diphtheria was unknown, but typhoid fever was prevailing. The child died after an illness of nine or ten days, croupy symptoms having set in three days previous to death:—"Lungs emphysematous in front; collapsed in patches posteriorly. A portion of false membrane was found at the bifurcation of the trachea. Trachea reddened, but elsewhere free from exudation. Larynx, epiglottis, pharynx, tonsils, and uvula covered with lymph. An abscess about the size of a walnut between pharynx and vertebræ. Liver, kidneys, and spleen healthy. Kidneys were examined microscopically."

Dr. Heslop furnished the details of a case of diphtheria complicating typhoid fever which came under his care in the Queen's Hospital in October 1852. The patient, a male aged 16 years, had the usual symptoms of typhoid fever. At the commencement of the attack, there was sore throat, with difficulty of swallowing and breathing. The throat was swollen and much inflamed, and the fauces were covered with a whitish, ash-coloured secretion. There was great prostration and general febrile action. A strong solution of caustic was applied to the throat, and alum gargles were prescribed. On the third subsequent day he is reported as better, as being able to swallow, but as still having pain in the fore part of the throat. From this time the throat got well, and

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the disease ran through the usual course of typhoid fever in a severe and protracted form.

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Dr. Heslop also mentioned the remarkable frequency of what he terms a diphtheritic taint in other diseases, especially those of the zymotic class, and cites the following cases in illustration:—In a case of acute rheumatism, which occurred at Christmas 1858, not merely was there endo-pericarditis, but the whole buccal membrane became coated with a fibrinous deposit. In November 1858 diphtheria became developed in a little girl aged seven years, suffering from typhoid fever. The fever was well marked and had gone on for nearly a fortnight before the appearance of the throat affection, which consisted of a well-marked diphtheritic exudation on the posterior fauces. The case was most lingering, and speech and the use of the limbs did not return for a lengthened period. Ten days later the mother was taken ill with typhoid fever, marked by the usual symptoms and an unusual number of rose spots, but unattended by diphtheria. Next a son, aged 10 years, also took typhoid fever, attended by rose spots, and after a few days by diphtheritic exudation on the throat. Both these cases did well. Whilst the two last cases were ill, another child, aged eight years, was also attacked with febrile symptoms, which never definitely assumed the character of typhoid fever, and were unattended by diphtheria, although the throat was reddened. A case of semi-confluent small pox, aged 21 years, was admitted into the Queen's Hospital, under the care of Dr. Heslop, on August 18th, 1858. On the 10th day of the eruption he complained of uneasiness about the throat and neck. The tonsils and fauces were observed to be slightly inflamed. "On the 27th complains of his throat. There are more decided evidences of inflammation of the tonsils, uvula, and fauces." A small patch of buff-coloured diphtheritic exudation was observed on the left side. 28th, inflammation diminished, but exudation remains. From this time he gradually improved, but the throat was not perfectly well until the 14th of September.

The following cases are reported by Mr. West, surgeon to the Queen's Hospital:—

H. D., a boy aged 12 years, when first seen (Dec. 12, 1857) appeared to be suffering from prostration, both bodily and mental, occasioned, as his mother thought, by the great exertions he had been making to fit himself for the school examination about to take place; he also complained of pain in the throat and difficulty of swallowing. Upon examination, some dirty white specks were visible on the right tonsil, to which solid nitrate of silver was immediately applied. Chlorate of potash, with tinct. cinchonæ, and hydrochl. acid, were ordered internally every four hours, and a gargle with hydrochl. acid to be used diligently. On the 16th quinine was substituted as an internal remedy; and as the exudation had greatly increased, and the patient was unable to use the gargle, it was injected several times a day, with the effect of bringing away many shreds of membrane and large quantities of viscous matter.

On the 19th he was much better as regards the throat, but was suffering much from weakness. Towards the end of the year, during the period of convalescence, deglutition became difficult, his food returning through the nose. The voice, which previously had been clear and harmonious, now became thick and snuffling, and at length the power of articulation was almost lost, so that it was only by the most painful effort he could make himself understood.

The throat upon examination appeared healthy, with the exception that the right tonsil was smaller (in consequence of former ulceration) than the left, and that the velum was relaxed and almost without motion. After these symptoms had existed a few days his sight also began to fail him. At first he could only see to read when the book was held at a great distance, but gradually this power diminished; he was unable to distinguish letters or even lines, and was compelled to give up reading altogether. Strabismus was also noticeable. His gait became uncertain and feeble, so that he moved about with great difficulty. Wine and nourishment were freely administered, but no marked sign of amendment appeared until Jan. 19th, when he was ordered into the country, where, in the course of three months, his recovery was completed, and he has since enjoyed the most perfect health.

A young woman, aged 20 years, applied at the Queen's Hospital in the autumn of 1857, as an out-patient, suffering from diphtheria. She was desired to come into the house, but declined to do so, as she preferred being with her mother, who lived in a badly sewered court in one of the lowest parts of Birmingham, at about the distance of a mile from the hospital. She was ordered eight grain doses of chlorate of potash every four hours; to use hydrochloric acid gargle, and to come up, if possible, or at any rate to send up to the hospital, each day. She came up two days in succession, although each day her strength appeared diminished, and on the second day her throat was much better; the fibrinous matter had almost entirely disappeared, and a red ulcerated surface remained. The same treatment was ordered to be continued, and she was requested to take plenty of wine and nourishment, and to exert herself as little as possible. The following day her mother reported her death. On reaching home the day before her death she said she was very tired, and after taking some refreshment went to bed. During the rest of the day she appeared heavy for sleep, and disinclined to take support. She refused any supper, but continued to doze and sleep through the night till seven in the morning, when she asked for breakfast. Whilst being raised to receive it she fell back fainting, and died before assistance could be procured.

A little girl, aged six years, was said to have been choked whilst eating her dinner. She had previously been noticed by her mother to have lost her appetite, and to be rather weakly, but had not received medical treatment of any kind. On my arrival the child was dead. The body was emaciated, and the fauces

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were found to be completely stuffed with a greyish-white fibrinous deposit; layer after layer were in succession removed before the tonsils and palate could be reached, and the deposit appeared to extend some way down the pharynx. There was no evidence of deposit about the larynx, nor any sign of inflammation, but around the epiglottis and external to it were several large plates of fibrin, which might and probably did assist in producing the dyspnœa which was noticed for the first time by her mother a few minutes before her death. There was no visceral disease whatever.

The post mortem examination made the following day showed that the fauces and pharynx were the seat of superficial ulceration, and here and there were small patches of semi-detached fibrin. The larynx and trachea were free from disease and fibrinous material. No disease existed in any of the abdominal or thoracic viscera.

The following interesting case is reported by Dr. Fleming, under whose care it was admitted into the Queen's Hospital:—

A. B. was admitted into the hospital under one of the surgeons for gonorrhœa. After two or three days she was transferred to the physician for papular rash, supposed to be secondary syphilis, but she soon presented remarkable and unaccountable depression, complained of the throat, and was so feeble as almost to faint when she sat up in bed to have it examined. The throat presented two or three patches of grey, coriaceous, membranous exudation, which rapidly spread so as nearly to cover the whole throat; the pulse 130, small and weak; very early in the disease the urine presented a slight trace of albumen; its specific gravity was 1012, and it contained lithates in great abundance. The throat passed through the usual stages; the membrane, on separation, left ulcers of the mucous membrane of the fauces; there was much sanious discharge from the mouth and nares; there was fœtor; a large hæmorrhage (arterial) oozed from the ulcers of the throat later in the disease. She never recovered from the depression produced by the hæmorrhage, and died on the 21st or 22d day of the illness, and the 19th from the accession of sore throat; the urine continued to show a trace of albumen up to the last, but the lithates were much less in quantity; suffered occasionally from difficulty of breathing. The rash very soon disappeared after the appearance of the exudation.

Post-mortem examination.—Several ulcers on the tonsils and upper and back part of the fauces; coriaceous membrane covering the upper part of the œsophagus, but too low down to be seen by the eye during life; larynx healthy; both lungs much congested; kidneys enlarged: cortical substance pale and granular; spleen enlarged and soft; heart healthy.

WORCESTERSHIRE: Redditch.—Dr. Nicholson observed two forms of the disease. One presented the usual characters of diphtheria; in the other the membrane was darker, about the colour of buff leather, coming off with difficulty, and when removed, either by design or accident, during the height of the

disease, the subjacent parts were hollowed out into deep, ragged, ulcers, very difficult to be healed, at the later periods of the disease. Albuminuria was more generally observed in this than the other form of diphtheria. In nine cases, reported also by Dr. Nicholson, six females, aged 19, 16, 7, 6, and 4 years, and three males, aged 15, 11, and 10 years respectively, sudamina appeared on the second or third day from the first appearance of the false membrane. These all did well, and made quick recoveries. In one case a rose-coloured eruption, similar to that of continued fever, occurred. The case was marked from the outset by alarming depression, but ultimately recovered. In three cases diphtheritic exudation appeared on the body. One of fistula in ano in a man aged 32 years, went on well for four days after being operated on. On the fifth day the membrane appeared, and speedily covered the wound. Sloughing eventually took place, under the use of caustics, leaving matters worse than before the operation. In a second case, false membrane formed on the pudenda, where the mucous membrane had been abraded by acrid discharge from the vagina. The former died, the latter recovered, but continued very weak at the time of the report. The third case was that of a female, aged 53, suffering from caries of the metacarpal bones of the second and third fingers; an abscess formed, and was opened, and on the third day the wound was covered with membranous exudation. Eventually amputation of the parts was performed, and subsequently the wound, instead of healing, became covered with fibrinous exudation, causing it to gape; hæmorrhage from the intestines supervened, and the patient sunk on the fourteenth day from the amputation. None of the three cases had any affection of the throat, but in all there was marked and persistent depression from the time of the appearance of the membrane on the several injured parts.

STAFFORDSHIRE: Wolverhampton.—The late Mr. Edwardes saw two cases in which there was an affection of the female genital organs in little girls simultaneously with diphtheria in the throat. Both were in the same house, and dying when seen. Two children had previously died in the same cottage. The lining membrane of the external labiæ was completely destroyed by a sloughy exudation, apparently of the same character as that affecting the throat and mouth. The family were very badly fed, scarcely ever tasting animal food; the cottage was crowded; placed near a piece of water, and the ground around it swampy and undrained. Mr. Coleman mentioned the case of a woman aged 22 years, who, after the membrane had disappeared, and she was supposed to be going on favourably, was seized with pain at the cardiac end of the stomach, much aggravated by taking food or wine. There was no recurrence of exudation in the throat, and she died three weeks from the commencement of diphtheria.

West Bromwich.—The following group of cases, which were under the care of Mr. Duncalf, will show how diphtheria and

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scarlet fever have been intermixed with and sometimes complicated each other.

Thomas Roberts, aged 36 years, was seized, in October 1857, with alternate shivering and flushing, followed by vomiting and fever; skin was very hot; face flushed; complained of headache, and of uncomfortable sensations in the stomach; pulse was full; urine scanty; bowels costive; no complaint of sore throat. On the evening of the third day a sudden and alarming change occurred. His body was bathed in perspiration; breathing irregular; pulse under 60; and there was the most profound collapse. He complained of pain and uneasiness in the throat, and on examination the tonsils, uvula, and pharynx were found to be covered with layers of fibrine, capable of being rubbed off, leaving a reddened abraded surface beneath. The sides of the cheeks and palate were studded with minute red points, on many of which were white specks. This condition of the throat and mouth, and the prostration, lasted for two or three days, when he began to improve under the free use of stimulants and quinine. The membranous exudation then began to come away piecemeal, leaving the surface below slightly ulcerated. There was also now a discharge, not fœtid, from the nostrils, and the submaxillary glands were large, and painful on pressure. It was quite a year before this patient entirely recovered from the effects of the illness.

On October 7th, while the above man was ill, a child, aged four years, residing in the house, had an attack of well-marked scarlet fever, without dangerous complication; and, on October 15th, a younger child also had mild scarlet fever.

Two miles from this man's residence lived his brother and sister, aged respectively 21 and 18 years. There was frequent communication with the patient during his illness. On October 12th, the sister had scarlet fever, marked by no unusual symptoms, and a fortnight later the brother had a well-marked attack of diphtheria, less severe than his brother, but attended by great prostration.

Barton-under-Needwood.—Mr. Birch, who saw cases of diphtheria there some years antecedent to the present epidemic, made *post-mortem* examinations of two children who died at that time. He found false membrane in the pharynx, extending through the glottis down the windpipe, and throughout the larger bronchi.

Leek.—The disease was here of mixed character. Scarlet fever was prevailing at the same time with diphtheria, and many cases occurred in which diphtheritic phenomena, so to speak, were ingrafted on to scarlet fever. The earlier cases were probably scarlet fever, although they had not always the characteristic eruption. They had not the characteristic exudation of diphtheria, and were attended by sloughing of the throat. By-and-by true diphtheria, attended by the exudation of fibrine, which was renewed again and again on being removed, made its appearance, the one form of disease merging, as it were, into the

other. But even at this later period diphtheria was intermingled with and often complicated scarlet fever. The inmates of the workhouse entirely escaped. Slight paralysis, or rather, perhaps, impaired power of motion and sensation, sometimes followed an attack, and was said to be more common in the hand or arm than in the lower extremities. The temperature of the surface in true diphtheria has usually been low, and the pulse often under the natural standard. In cases of scarlet fever, complicated with diphtheria, the skin has generally been hot, and there has been distinct febrile excitement. The membrane becoming dark coloured, or sometimes almost black, was always a most unfavourable sign. Death sometimes occurred most unexpectedly. One patient of Mr. Ritchie's, who had been considered so well that he had discontinued his attendance, became suddenly worse. There was sickness and great depression; the patient had become cold, without hæmorrhage or other ostensible reason. He sat up in bed whne visited, answered questions, laid himself back, stretched his arms, and died before the medical attendant left the room. The throat was quite well before the first attendance ceased. A second case occurred in which a child died in its chair immediately after having been examined by the surgeon. Impaired vision was a common sequel. Mr. Ritchie, who himself had diphtheria, which he believes was contracted from a patient, had impaired vision for some time after his recovery. Wandering of the mind very frequently preceded death.

CHESHIRE: Nantwich.—In three cases under the care of Dr. Bellyse, the patients became almost blind during convalescence. In one case almost complete deafness came on long after the swelling of the glands had disappeared, and continued for some time, but at length the hearing was perfectly restored. In one case there was complete paralysis of the lower extremities, which continued for some weeks, when sensation and power of motion gradually but very slowly returned, accompanied at first by tingling, and intense tenderness of the integuments. In this case the patient's head was drawn on one side for weeks; there was rigidity of the muscles of the neck, with great tenderness and complete aphonia for three weeks. The disease also in this patient appeared to creep downwards to the stomach, as indicated by vomiting and gastrodynia, followed by diarrhœa. Convalescence was most slow, but at length perfect. Another patient in the same house died very suddenly. He appeared to have nearly recovered, and the day of his death walked some distance. In the evening, when seen, he was found in a state of collapse, from which he never rallied, but died in about an hour after being visited, and only nine hours after he had been walking out of doors.

NORFOLK: Cromer.—The early symptoms here were usually slight headache, languor, and chilliness. On examining the throat, of which little or no complaint may have been made, the charac-

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teristic exudation already existed. Vomiting is an occasional, but rare premonitory symptom. Sloughing was, at least, a very rare event. Depression was always a marked symptom. There was remarkably little constitutional disturbance, and patients often sat up or lounged about until almost the moment of death. The urine was repeatedly examined by Mr. Cooper of this place, in every stage of the disorder, but without finding albumen. In addition to the paralysis, noticed elsewhere, severe neuralgic pain of the limbs sometimes followed diphtheria here. Severe pain in the ears, in swallowing, was common, patients begging, in consequence, to have their ears firmly pressed before attempting to swallow. Phthisis was rapidly developed in one patient after diphtheria, the patient being previously in good health. Tubercular meningitis also immediately followed diphtheria in one child, and proved fatal 10 weeks from the commencement of diphtheria. Mr. Cooper had seen the characteristic membranous exudation upon blistered surfaces, and in one instance upon the pudenda of a child, without diphtheria of the throat. In another little girl, suffering from diphtheria, but not confined to bed, an ulcer formed spontaneously upon the nates, and assumed the diphtheritic character, being coated with false membrane. In the only *post mortem* examination which was made the disease was found to be limited to the throat and larynx; the lungs and kidneys were healthy.

North Walsham.—Diphtheria has here occurred in conjunction both with chicken pox and scarlet fever. The tonsils sometimes suppurated, and required to be opened, even in cases attended by false membrane. Several cases were attended by purpura, and a few, in the practice of Messrs. Coleby and Sheppard, by a rough papular eruption. Diphtheria was unattended by fever or by much constitutional disturbance, and often proved fatal from exhaustion; the breathing remaining unembarrassed, and the intellect perfect to the last moments of life.

Coltishall.—The premonitory indisposition was so slight, as scarcely to attract the notice of friends. In one case, under the care of Dr. Evans, the parents asserted the child to be quite well, but the throat, on examination, presented the characteristic exudation, and the patient died. In another patient there was ulceration below the membrane when the latter was removed. The membrane formed again day by day, on each occasion becoming smaller, until, after a protracted illness, the child recovered.

Stalham.—There was here very slight premonitory indisposition, and often little or no pain in the throat, even when covered with exudation. The majority of the patients have died with croupy symptoms; few of exhaustion. Two cases in the Messrs. Clowes practice were followed by strabismus; both recovered. Sometimes recovery has been protracted for months, attended by vomiting, cough, profuse expectoration, and the physical signs of bronchitis; patients lying from day to day without much change, without appetite, and with frequent threatening of sinking. There was always in such cases much difficulty of swallowing, and aphonia, and sometimes death, has ensued. In one case, aged

32 years, diphtheria was followed, after an interval of 10 days from the beginning of the illness, by purpura. The membranous exudation had quite disappeared. There was bleeding from the gums, fauces, nose, vagina, and anus. The nates suppurated, and the patient died.

Smallburgh.—Croupy symptoms were here also very common, and cases generally died when they became established. The only case of recovery after the disease had extended to the trachea was that of a patient who brought up a tubular cast, about two inches in length, and a little thicker than a swan quill. It was rejected after the administration of an emetic. Pneumonia has in a few instances followed diphtheria. Purpura has also attended in a few cases of diphtheria, but no other eruption has been noted.

TREATMENT OF DIPHTHERIA.

Of between 80 and 90 medical practitioners who favoured me with notes of the mode of treatment they had adopted, not one thought he had discovered a specific internal remedy, but one or two placed great reliance upon particular local applications. No one advocated tracheotomy, an operation which has been very rarely, and in no case, so far as I could learn, successfully tried. A few gentlemen treated their early cases antiphlogistically; but with the exception of one practitioner, who still begins his treatment with calomel and rhubarb or castor oil, and another, who thinks antimonials of use, all speedily abandoned the antiphlogistic, and adopted a more supporting or even stimulating plan of treatment from the very commencement of the disease. The treatment may be conveniently considered as external, local, internal, and dietetic.

EXTERNAL TREATMENT.—*Leeches* were applied in a few cases, either to the external throat or temples, without benefit.

Blisters appear to have been useless as regards the throat affection, but perhaps sometimes of service in pulmonary complications. The same observation applies to sinapisms.

Fomentations and Poultices to the neck have been considered useful. Amongst others, yeast and vinegar poultices were tried by one gentleman, with what advantage does not appear very evident.

Tinct. of Iodine was sometimes applied to the enlarged glands, as might be expected, with no decided advantage during the active period of the disease.

LOCAL TREATMENT.—*Solid lunar caustic* has been very frequently applied to the throat, and has sometimes appeared useful when employed in the earliest stage, and before the local affection was extensive. Solutions of lunar caustic, of various strengths, from gr. v. to ʒi. to the ounce, applied with a sponge or brush, were even more commonly used, and several practitioners of wide experience spoke most favourably of the benefit derived from the application.

Hydrochloric acid, either applied with a brush at longer intervals, as once a day, in a nearly concentrated form, or very slightly diluted with water, or used more frequently in a diluted form as a

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gargle, has been much approved by several very careful and observant practitioners.

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Tincture of the sesquichloride of iron, either painted on to the mucous membrane with a brush, or used in a diluted form as a gargle, has appeared useful in some hands.

Beaufoy's solution of chl. soda applied to the throat in a concentrated form with a sponge has been much used by some of the practitioners around Spalding, and by a few elsewhere. The same preparation in a diluted form has been used as a gargle. The evidence respecting its usefulness was most contradictory; some gentlemen considering it as almost a specific, others as at least useless.

Garyles of several kinds, alum, tannin, port wine, and capsicum, in addition to those already mentioned, have been tried, but with doubtful success.

Glycerine and hydrochloric acid, applied to the throat, was tried by one gentleman, but ultimately abandoned, as not more successful than other applications.

Scarifying the tonsils was tried without benefit.

Removal of the exudation by brushes, sponges, or the use of detergent applications, has been very generally practised, so few practitioners having adopted the opposite course that it is at present difficult to determine, from experience, whether it is best to meddle with it or not.

INTERNAL TREATMENT. — *Tincture of the sesquichloride of iron* has been far more extensively used than any other remedy, and many practitioners, who had previously tried other medicines, have latterly adopted it, and consider it as the most successful. My own opinion of it is favourable, but it has not yet been sufficiently tested to speak of its value with entire confidence. It has been given simply with water, or with an additional quantity of hydrochloric acid. It has also been given in conjunction with chlorate of potass and with quinine.

Chlorate of potass has next, after the last medicine, been the most generally employed, and it, too, has sometimes been given in plain solution, but more frequently in combination with dilute hydrochloric acid, or with decoction or tincture of cinchona, or tincture of the sesquichloride of iron. Some practitioners have placed great reliance upon this remedy.

By several practitioners a mixture of chlorate of potass, hydrochloric acid, and water, analogous to the chlorine mixture often employed in the treatment of scarlet fever, was much lauded as a successful remedy in diphtheria. The formula given for its preparation differed from that in common use, in containing a larger proportion (℥i) of chlorate of potass to the half pint.

Quinine has been sometimes trusted to, and large doses have been administered, even to young children. Decoction of cinchona, with or without chlorate of potass or ammonia, has likewise been tried.

Sesquicarbonate of ammonia, in full doses, has been tried in a few cases, and so has the muriate of ammonia; but neither of

them sufficiently often, or with sufficient attention to the effect, to afford trustworthy data for determining their value.

Acetic acid, in doses of half a drachm, with an ounce of water, every three or four hours, has been tried, but without remarkable success.

Emetics have been employed in two stages of the disorder; at the commencement, and on the accession of croupy symptoms. In both they are believed to have sometimes been useful.

Cod liver oil, the ammonia-citrate of iron, and similar remedies, have rather been employed as remedies for hastening convalescence than as curative of the disease in its active stage; they have undoubtedly been useful.

Stimulants hold an intermediate position between medicine and food; and nearly all authorities are agreed upon their value, and the necessity for their employment. Some practitioners have commenced with them at the outset; others have waited for the arrival of decided indications of depression; all are agreed that their use is the most essential part of the treatment in the later stages of the disease. Wine, brandy, and, by a few persons, ether, have been used as stimulants; and those who have used ether during the more depressed period of the disease, speak favourably of its effects; its use has, however, been very restricted.

DIETETIC TREATMENT has been one of the difficulties in the treatment of diphtheria; in some cases, from the difficulty of swallowing; in more, from absolute indisposition for food great difficulty has been experienced in giving the patient the amount of support that was considered necessary. The support must necessarily be altogether liquid; and beef tea, egg and wine, or brandy, and similar articles of diet, have been mostly preferred, One practitioner recommended milk as a diet not unpleasant to patients, and another cream, in considerable quantities, with rum. In only one instance did I hear of any attempt being made to support patients by beef tea enemata, when unable to take sufficient nourishment by the mouth.

DIPHTHERIA in LINCOLNSHIRE, STAFFORDSHIRE, HERTFORDSHIRE, NORTHAMPTONSHIRE, KENT, DEVONSHIRE, and CORNWALL.

*Information collected by Dr. Sanderson.**

The observations recorded in the following paper are the results of journeys undertaken to various parts of England in which Diphtheria has been epidemic, for the purpose of making inquiry regarding the symptoms, causes, and mode of diffusion of that disease. The following localities were visited:

1. The district of Axholme, on the west side of the Trent and north of Gainsborough (Lincolnshire).

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* My cordial acknowledgments are due for the aid and information I have received from medical men in all the localities I have visited; especially to Mr. Thomson of Launceston, Mr. Ellis of Crowle, Mr. Scott of Hanley, Messrs. Maund and Whitfield of Ashford, and Mr. Pittock of Sellindge.

2. The district of Launceston and Tavistock, constituting the upper part of the valley of the Tamar (Cornwall and Devon).
3. The pottery towns of Staffordshire.
4. The village and parish of Hertingfordbury, near Hertford.
5. Barton on the Humber (Lincolnshire).
6. The village of Rothwell, four miles north of Kettering (Northamptonshire).
7. The north-eastern district of Kent.

I. General Features of the Districts.

a. *Level, Exposure, &c.*

Three of the districts, Launceston, Axholme, and East Kent, exhibit such marked differences of feature and conformation that they require special description. Of the rest it is sufficient to say that the town of Hanley, in which diphtheria was more prevalent than in any other of the pottery towns, is built on a hill which overlooks the whole of the surrounding district, and is said to be the highest town of its size in England. The town of Barton is situated partly on the alluvial level which borders the south bank of the river Humber, partly on the ascent of the hills which overlook it. The villages of Rothwell and Hertingfordbury occupy sheltered valleys in an undulating country. At the latter place, however, diphtheria occurred with equal severity in the hamlets on the neighbouring high grounds, and in the village itself.

Axholme.—The alluvial tract of country on the west side of the river Trent, between Gainsborough and the Humber, bounded by the Trent, the Idle, and the Old Don, the channel of which last still marks the boundaries of the counties of Lincoln and York, includes a number of villages, all of which, with the exception of Owston, I have visited. They may be enumerated as follows:—

a. On the banks of the Trent, Owston, Butterworth, Althorpe (335),* Keadby (602), Amcotts (410).
b. On the banks of the Don, Eastoft (460), Luddington (588), Garthorpe (502).
c. On a series of rising grounds surrounded by marsh land, extending from north to south, Haxey, including Westwoodside and Crazelound, &c. (2129), Epworth (1944), Belton (1738), Crowle, including Ealand (2548).

Until the 17th century, each of the last-mentioned villages was an island, the whole of the surrounding marsh lands being then permanently submerged. The Old Don, which is now a mere stagnant ditch, was then a navigable river, and the villages on its banks must have been places of much greater importance than at present. Crowle is situate on the western slope of the hill on which it is built, and its suburb, Ealand, holds a similar position on the south of the same hill. The church and market-

* The figures indicate the population in 1851. I am not able to state the populations of Owston and Butterworth, as these villages are included in the Census Returns with others east of the Trent.

place of Epworth crown the summit of another hill, from which the village extends half a mile to the north-west. The village of Haxey is built on a third hill, around the base of which, toward the south and west and adjoining the marshes, are situate the hamlets of Crazelound and Westwoodside. Throughout the whole of the remainder of the district the surface is level.

Launceston.—The district surrounding Launceston exhibits the most varied features. It includes barren elevated moorlands, and low-lying alluvial valleys. Some of it is wooded and fertile, the rest incapable of successful cultivation. It is included between the River Tamar and its branches the Imry and the Yeolm. Both of these flow in a direction from north-west to south-east, and are separated by elevated ridges. On the crown of one of these ridges, that which forms the southern boundary of the valley of the Yeolm, are situated the villages of Egloskerry, St. Stephens, and Tresmeer. On another, running in the same direction, to the south of Launceston is situated the village of South Petherwyn, while the intervening ridge is crowned by the town of Launceston itself. Another village, Llaneast, is situated on the southern slope of the barren hills which separate the tributaries of the Tamar from the streams which flow into the Bristol Channel. (Sect. IV. a.)

East Kent.—The north-eastern district of Kent is divided into two parts by the River Stour, which flows northwards from Ashford to Chilham, north-eastward from Chilham to Canterbury, after passing which city it pursues a winding course, the general direction of which is eastward, and joins, near Sarr, the now almost obsolete channel which separates the Isle of Thanet from the rest of Kent. The Stour is bordered on either side by alluvial lands; above Canterbury these are of inconsiderable extent, but below that city widen out into a broad band of marsh, which is continuous with the marshes of Thanet. Between that island and the main land there was formerly a navigable channel, which, indeed, in Roman times, and for centuries later, constituted the principal approach to the estuary of the Thames. The marshes above mentioned now occupy this channel, extending from the Reculvers to the mouth of the Stour near Sandwich, and from thence along the coast to Deal.

A second and perfectly distinct tract of marsh land, also included in this inquiry, stretches along either shore of the Swale from the Medway to Whitstable, comprising the south side of the Isle Sheppey.

Next to the marshes the most important features of the district are those dependent on its geological structure. By far the greater part of it is occupied by the chalk, the southern limit of which coincides broadly with the range of hills which extends westward from the cliffs north of Folkestone to Wye, between which village and Ashford it is interrupted by the valley of the Stour, but reappears in Eastwell Park. On the north it is bounded by a line

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parallel with the north bank of the Stour from Chartham to Canterbury, which coincides further west with the road from Canterbury to Sandwich. West of the Stour and on the slopes of the hills between Wye and Dover the chalk district is richly clothed with wood and coppice, and much of it consists of park lands. Further north it forms an elevated and exposed tract of country of considerable extent,* which may be described as lying on either side of a line drawn from Dover Castle to Canterbury. The high grounds along this line are for the most part open chalky downs, and the deficiency of wood, as compared with its abundance in other parts of Kent, cannot fail to strike the observer. North of this line, as already indicated, the chalk passes beneath the lower tertiary strata of the London basin, which in their turn are covered by alluvium in the valley of the Stour.

Subsoil.

The subsoil of the marsh lands of Axholme is entirely formed by the process of *warping*, which consists in allowing the waters of the Trent, loaded with silt, to flow over them at every tide for a period of three years, by which means the land is covered with a deposit of alluvium about a foot in thickness.

On the high grounds around Crowle and Haxey, the subsoil is in some places tenacious clay suitable for brickmaking, in which beds of gypsum are met with here and there; more commonly, however, it consists of alternating layers of sandstone, gravel, and the crumbling rock called in the neighbourhood waterstone.

In the Launceston district the subsoil is also determined by the geological structure. The prevalent rocks are slates and shales; in the northern parts of the district these are purely argillaceous, and are for the most part covered by yellow clay, resulting from their disintegration, and of no agricultural value. In the more fertile southern division slates are met with, containing carbonate of lime with intervening limestones, in addition to which there occur, at various points near Launceston, beds of greenstone and lava-like vesicular trap infiltrated with the same substance. Agricultural drainage is in extensive operation in the south part of the district, much neglected in the north.

The subsoil of Hanley, excepting where the carboniferous shales and sandstones appear above the surface, is almost invariably impervious drift clay, rarely mixed with sand.

In the Hertingfordbury district the subsoil of the slope on which the village is situated is a light and extremely penetrable gravel; that of the higher grounds is a stiff and impervious loam, a circumstance which, combined with the local conformation of the surface, is unfavourable to drainage.

In the eastern district of Kent the varieties of geological structure above described exercise an important influence on the subsoil as regards its permeability to moisture. In the chalk district the subsoil either consists of a thin covering of vegetable mould mixed

* In this district diphtheria prevailed with the greatest fatality.

with a variable proportion of flints, as is observed on the crowns and slopes of the hills, or in the valleys of chalky loam of various degrees of tenacity.

In the tertiary district the subsoil differs, as regards permeability, according to the nature of the strata exposed.

In het country between Chilham and Faversham and in the district east of Canterbury, between the chalk hills and the Stour, it consists of highly permeable sands or of pebble beds, such as those which form the tops and sides of the wooded hills of Selling; on the other hand, the high grounds which stretch from the coast between Whitstable and Reculver towards Canterbury, consist of a mass of London clay which is perfectly impenetrable.

In the district extending from Ashford to Hythe, between the chalk hills already mentioned and Romney Marsh, the subsoil is generally highly permeable; the only exception being that a narrow belt of gault clay is found at the foot of the slopes underlying the chalk, and intervening between that structure and the lower greensand. South of this belt successive strata of gravel, sands, and Kentish rag are met with, all of which are extremely favourable to natural drainage.

b. *Water-supply.*

In all the districts, with the exception of Hanley, the water is derived from pumps. Its character does not appear to merit comment in any instance excepting that of Hertingfordbury. I found that in that district, owing to the extraordinary deficiency of rain during the autumn quarter of 1858, the wells, which vary usually from 12 to 30 feet in depth, were almost exhausted (Feb. 1859). The water from one of these wells was examined chemically and microscopically it was found to contain about two grains in the gallon of suspended organic impurity, consisting, for the most part, of vegetable debris, but partly of unicellular algæ and protozoa. The water contained 5·2 grains in the gallon of dissolved organic impurity, and 17·4 of inorganic solids, consisting mainly of salts of lime and magnesia. The water of another well in the village of Hertingfordbury, which possessed all the obvious qualities of good water, was also examined. It contained 5·1 grains in the gallon of organic matter in solution, and 32·6 of inorganic. Neither of these waters possessed qualities of such a nature as to be likely to interfere with health.

c. *Endemic Diseases.*

In Kent, in the marshy districts, ague is said to have been for some time past more than usually prevalent, and elsewhere it had been observed during the last three years that cases had occurred in localities where the disease had before been unknown, and which appeared, from their elevation and exposure, beyond the reach of malaria. At the outbreak of diphtheria at Ash ague had not been met with in the village for many years, and no cases occurred during the progress of the epidemic; but since its cessation ague has prevailed yearly.

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No endemic diseases are met with in any of the other districts excepting Axholme, where ague occasionally attacks the Irish immigrants, but never occurs among the residents.

II. The Duration, Extent, and Novelty of the Epidemic in each District.

a. *Duration.*

The duration of the epidemic in each of the districts is indicated by the following dates:—

Axholme.—Crowle, first case, September 18th, 1858; acme of the epidemic, January 1859; declension, towards the close of 1859.

Haxey and hamlets, first case, December 25th, 1858; acme at Crazelound in June, and at Westwoodside in September 1859. Now declining.

Eastoft, first case, May 20th, 1859; last reported, September 7th.

Luddington, first case, March 12th, 1859; last reported, September 1st.

Garthorpe, first case, July 29th, 1859; last reported, September 7th.

Launceston.—First case, September 30th, 1855; acme, August 1856; cases still occurring April 1859.

Hanley.—First case, July 1858; last, June 1859.

Hertingfordbury.—First case, October 15th, 1858; acme, January 1859; last, March 1859.

Barton.—First case, September 7th, 1858; last, June 10th, 1859.

Rothwell.—First case, April 11th, 1859; last reported, June 11th 1859.

Kent.—Ash, first case, November 7th, 1856; last case, November 10th, 1857.

During this period diphtheria existed in no other locality excepting at Herne Bay, where one or two cases were met with. Mild cases have occurred at intervals at Ash up to the present time.

Canterbury, first case, June 5th, 1857; cessation of the epidemic, July 1858.

Ashford, first case, December 1857; second, October 1858; acme of the epidemic, January 1859; cases still occurring, March 1860.

Barham, first case, July 1858; prevalent from November 1858 to May 1859. Two groups of cases occurred in December and January last.

Shaddoxhurst and Kingsnorth, first case, October 15th, 1858; cessation, January 1859.

Walmer and neighbouring villages, from October 25th, 1858, to the present time.

Sibertswold and Coldred, October and November 1859.

Wickham, from October to December 1858.

Birhington, first case, March 27th, 1859; cases still occurring.

Goodnestone, from June 22nd to September 2nd, 1859.

Littlebourn and Nonington, from June 1859 to the present time.

Kennington, April to June 1859.

Great Chart, December 1859 and January 1860.

b. *Number of Cases and Deaths in each District.*

As regards this point, I have accurate information relating to a few localities only. In the others the following numbers are approximative, being derived from the statements kindly furnished to me by practitioners:—

Axholme—

Crowle and Ealand	161	cases,	103	houses,	30	deaths.	
Haxey and hamlets	150	„	—	„	25	„	
Eastoft	20	„	8	„	5	„	
Luddington and Garthorpe	17	„	12	„	2	„	
Isolated cases	38	„	26	„	7	„	

Launceston.—At Launceston, and in the neighbourhood, there were probably about 1,000 cases. The number of deaths, and of families attacked, cannot be determined. 126 unselected cases, of which I have particulars, occurred in 98 families; 18 of them were fatal.

Hanley.—Probably 40 cases occurred in Hanley, including Etruria, and 6 in Stoke. 18 deaths appear on the register as caused by diphtheria; of these, 10 were ascertained to be really owing to that disease.

Hertingfordbury.—At Hertingfordbury there were 53 cases distributed in 30 households, and 14 deaths.

Barton.—At Barton the number of cases cannot be ascertained; 17 deaths are attributed to diphtheria in the register.

Rothwell.—At Rothwell there were about 25 cases, and 3 deaths.

Kent.—At Ash there were 58 deaths, and about 300 cases.

At Ashford there were about 100 cases. The total number of deaths was 15: 67 cases occurred in the practice of Messrs. Whitfield and Maund, and were distributed among 45 households. Of these 11 were fatal.

At Kingsnorth there were about 30 cases and 3 deaths. At Chart, 18 cases and 6 deaths. At Kennington, 23 cases and 5 deaths. In other villages smaller numbers.

At Canterbury, according to returns furnished to the East Kent and Canterbury Medical Society, there were 62 cases, distributed among 40 families, and 19 deaths.

At Goodnestone and the neighbouring villages, 65 cases occurred in 37 families; 10 were fatal.

At Littlebourn, Adisham, and Wickham, 49 cases were distributed in 25 households; there were 18 deaths.

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At Barham about 53 cases, and 9 deaths. At Sibertswold about 20 cases, and 16 deaths. At Walmer and the neighbouring villages about 50 cases, and 38 deaths. At Birchington, 28 cases, and 7 deaths.

c. *Previous Epidemics.*

About 24 cases are stated by Mr. Dodge, of Lifton on the Tamar, to have occurred near that village in 1852 ; none of them were fatal.

In 1817 an epidemic of malignant sore throat, which proved extensively fatal to children, was never accompanied with any eruption, and differed from scarlatina in the insidiousness of its onset and the absence of febrile reaction, prevailed at Ashford and the neighbourhood. A practitioner now living at Ashford, who himself suffered from the disease and lost a brother and two sisters by it, describes the condition of the fauces as identical with that of diphtheria.

There is no recollection of diphtheria having before prevailed in any of the other districts.

III. Contemporaneous or Recent Diseases.

a. *Other Varieties of Sore Throat.*

Crowle.—At Crowle, and at Haxey, two varieties of sore throat occurred along with diphtheria, often in the same families, with the more serious disease ; viz. adenitis, attended with very slight internal swelling or redness ; and erythematous sore throat, without swelling, either external or internal.

Launceston.—At Launceston there were numerous cases in which erythematous sore throat was accompanied with abrasion of the mucous membrane, the abraded surface not being covered with any concretion. These occurred so constantly in the same families, and at the same time with diphtheria, that there can be no doubt that they formed part of the epidemic.

Hanley.—At Hanley the same affection without ulceration prevailed along with diphtheria ; it affected simultaneously all the members of a family in which one case had arisen.

Hertingfordbury.—At Hertingfordbury it prevailed so generally, that it appeared that scarcely a child in the village was exempt from it.

Kent.—At Ashford, during the prevalence of diphtheria, a peculiar and intractable form of erythematous sore throat is described as having been met with, characterised by the presence of a roughened condition of the mucous surface. It frequently happened that this affection occurred simultaneously and in the same households with diphtheria. In two cases related to me by Mr. Hulke of Deal, erythematous sore throat without concretion was followed by the sequelæ of diphtheria. In both there was intense redness and swelling of the fauces, accompanied with adenitis. Convalescence was followed in one of these cases, that of a lady,

æt. 35, by amaurosis, in the other a boy, æt. 8, by amaurosis and strabismus, in both instances continuing for several weeks.

It is recorded that at Ash erythematous sore throat prevailed not only during the epidemic of diphtheria, but for some months previously. Here, as in many other places, it was accompanied with ulceration. This ulceration I had the opportunity of observing at Brabourn. It consists in a superficial abrasion of the congested and swollen mucous membrane, confined to the tonsils, and limited by a well-defined eroded margin.

b. *Scarlatina.*

Axholme.—In the Axholme district scarlatina had not been seen for several years, excepting at the village of Keadby on the Trent, where it prevailed during the spring of 1859 in a mild form, until October of the same year, when a few cases occurred at Crowle.

Launceston.—Near Launceston scarlatina prevailed in some villages at the same time with diphtheria, while in others it was entirely absent. At the time of the epidemic, the disease was almost unknown in the district. At Jacobstowe in the end of 1858, and at Camelford during the spring of 1859, scarlatina was fatally prevalent. Cases of diphtheria occurred at the same time, the attacks of latter disease sometimes preceding, sometimes following, those of the former.

Hanley.—Scarlatina prevailed extensively, contemporaneously with the occurrence of cases of diphtheria, in all the pottery towns. At Burslem, from which town diphtheria was almost absent, scarlatina was especially fatal.

Hertingfordbury.—At Hertingfordbury, scattered cases only of scarlatina occurred during the epidemic.

Barton.—At Barton, scarlatina prevailed in its most malignant form at the same time with diphtheria. During the eight months ending May 1859, it proved fatal to 65 children. The two epidemics appeared to commence, culminate, and decline at the same times.

Rothwell.—At Rothwell, scarlatina prevailed during the autumn of 1858, that is some months before the first case of diphtheria. It was mild and in no case fatal, and had entirely declined in February 1859.

Kent.—In most of the localities visited by diphtheria, scarlatina was not seen during its prevalence. One or two cases were met with at Wye, and several in the villages between Deal and Dover, all of a mild character. There were no cases of scarlatina in the village of Ash during the prevalence of diphtheria, but several occurred in the surrounding hamlets. (Sect. V., e.)

c. d. *Other diseases.*

Neither erysipelas, nor puerperal fever, nor common continued fever concurred with diphtheria in any of the districts.

e. *Diphtheria among Swine.*

During the prevalence of diphtheria at Hertingfordbury similar affection was observed among swine. Three sows, which were the subjects of it, were attacked severally on the 19th, 20th, and 22nd of December 1858. The sty inhabited by these animals was contiguous to a cottage in which cases of diphtheria were at that time under treatment; and it was suggested that they might have swallowed the discharges or concretions from these patients, which were thrown on a piece of waste ground to which the animals had access. The first sow attacked was observed on the day that she died to have enormous swellings of the sub-maxillary glands, and to be unable to swallow. She had been apparently in health the previous day. An anatomical examination was made next day in presence of Mr. Elin, of Hertford, who states that there was intense redness and swelling of the fauces, the mucous membrane being covered by a characteristic membranous concretion. In one of the animals death was preceded by symptoms of suffocation, the head being thrown violently backwards, and the body rolled from side to side. It is worthy of notice that a number of sucking pigs kept in the same building remained exempt. These last animals did not leave the sty.

I made extensive inquiries at Crowle, where large numbers of swine are kept, as to the existence among them of any disease resembling diphtheria, with a negative result.

IV. Local and Personal Conditions predisposing to Diphtheria.

The influence of local conditions and of age on the distribution of diphtheria in the town of Crowle is shown in the following table:— Crowle contains 550 houses; of these I visited systematically 263, included in 12 streets, inhabited principally or entirely by the poor. If the town be divided by a line stretching east and west, parallel with and on the south side of Cross Street, it will be found that the northern division includes by far the greater number of the streets in question, in which 69 per cent. of the cases of diphtheria occurred. Again, dividing this district by a line running north and south, parallel with the main street, we have a north-east division, which is on the whole elevated and airy, and a north-west, which is more or less damp and confined, the houses being more numerous relatively to the area. The table exhibits the general results of my inspection of these two districts, and of the remaining streets visited in the southern division of the town.

TABLE I.

TABLE showing the Total Number of Households, Adults, and Children, and the Number of Households invaded, and of Children and Adults attacked in certain Districts of the Town of Crowle, Lincolnshire.

	Families containing Children.					Families not containing Children.		
	Total.		Attacked.			Total.	Attacked.	
	No. of Families.	No. of Children.	No. of Families.	No. of Children.	No. of Adults.	No. of Families.	No. of Families.	No. of Persons.
North-east District -	62	154	27	34	8	30	5	7
North-west District -	58	137	26	27	19	45	8	10
Other Streets - -	35	98	10	18	1	33	5	6
Total - -	155	389	63	79	28	108	18	23
	a	*b*	*c*	*d*	*e*	*f*	*g*	*h*

From the table it appears—

1. That in the whole number of houses inspected, the liability to be invaded by diphtheria, or, in other words, the proportion of the number so invaded to the total number of households ($=\frac{c}{a}$) was 0·406, or 40 per cent. as regards the houses containing children, and that the corresponding proportion ($=\frac{g}{f}$) as regards those consisting of adults only was 0·166, or 16 per cent.

2. That in the former class of households adults were attacked in the proportion 0·090, or 9 per cent. ($=\frac{e}{2a}$ assuming each family to contain 2 adults) and children in the proportion 0·2006, or 20 per cent. ($=\frac{d}{b}$).

3. That in the two northern districts the proportions $\frac{c}{a}$ and $\frac{g}{f}$ were considerably greater than in the streets in the southern district, but nearly equal to each other.

a. *Local Condition.*

In relation to the question in what number and with what severity cases occurred in dry and airy parts of the district, as compared with low-lying, damp, and confined parts, the following facts are worthy of notice.

Crowle.—In the town of Crowle the inclination of the surface is generally equal, and consequently all parts are equally airy. To this a locality called Pitholes, in which the ground has been excavated at a former period to the extent of an acre for the purpose of procuring gypsum, forms the only exception. The level of this place being considerably below that of the neighbourhood, the surface drainage from the dwellings and pigsties finds

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its way to the lowest point, where it is collected in a covered cesspool or tank. In Pitholes there are 20 cottages and as many families, 15 of which contain children under 12 years of age. Of these families, 11 were invaded by diphtheria; there were 17 cases and 6 deaths.

Haxey.—At Haxey it was found that although diphtheria prevailed in the village itself, which is high and exposed, it was much more fatal and attacked a much larger proportion of families in the low lying suburbs of Crazelound and Westwoodside. In the former of these, cases occurred probably in three out of four of the families, and in the latter I was assured that there was scarcely a household exempt.

On the other hand it is not less remarkable that in the villages of Butterwick, Althorpe, Keadby, and Amcotts, all of which are on the banks of the Trent and surrounded by marsh land, four families only were attacked.

Launceston.—In the district around Launceston the localities which have been most severely visited by diphtheria have certain topographical characters in common, which although not striking at first sight are well worthy of attention. Their universality is suggestive to the mind of a real relation between diphtheria and the conditions they express. All the villages invaded by diphtheria, with scarcely an exception, are in elevated situations. Many of them are on the ridges or slopes of the hills, as, *e.g.*, South Petherwyn, St. Stephens, Egloskerry, Tresmeer. Those which are sheltered are none of them in the low lying agricultural districts bordering the Tamar and its larger tributaries, but in the elevated moorland valleys which stretch upwards towards the Cornish hills to the north, or in the south part of the district towards Dartmoor Forest, *e.g.* Llaneast, Jacobstowe, North Petherwyn, Walkhampton, Merivale, Postbridge.

It is to be remembered that these villages, although elevated, are not necessarily airy, and that, in some of them particularly, from disadvantages of inclination, as well as from the impermeability of the subsoil, the ground is soaking with moisture.

Hertingfordbury.—In the district of Hertingfordbury no relation could be traced between the elevation or exposure, or the inclination of the surface in the invaded localities, and the frequency of cases. The village, owing to the pervious nature of the subsoil and the favourable conformation of the surface, is remarkably dry and airy. In the other hamlets in which the disease prevailed the ground is level and the subsoil impenetrable, and the cottages are built on patches of undrained common land.

Kent.—Of twenty-four villages, including in the list all of any importance situated on the range of chalk hills between Canterbury and Dover, viz., **Adisham (401), Barfreston, **Barham (1,105), *Beakesbourn (362), *Bridge (864), **Chillenden (140), **Coldred (182), *Eastry (1,697), **Eythorne (435), **Goodnestone, Ickham, Kingston (310), **Littlebourn (745), **Mongeham (370), **Nonington (875), *Northbourn, **Ringwold (789), **Sibertswold (422), *Staple (590), Tilmanstone, **Waldershare,

**Wickham, *Wingham (1,083), and Womenswould, diphtheria prevailed epidemically in 13, marked ** ; isolated cases occurred in those marked * ; while the rest were believed to be exempt.

Barham, Kingston, Bridge, Beakesbourn, Littlebourn, and Wickham are all situated in the valley of a tributary of the Stour (the little Stour); the three last are in immediate proximity to the marsh, which here extends upwards for several miles between the chalk hills from the valley of the Stour. Barham is four or five miles higher up the stream ; it is situated on the northern slope of the valley, the trough of which is at that part occupied by a very inconsiderable area of alluvium. Bridge and Kingston are in similar positions. Wingham, Eastry, and Staple are also in valleys which trend to the eastward, and have a similar character to that of the little Stour ; but as regards Wingham, it is to be noticed that the cases occurred not in the village, but in a hamlet on the crown of a neighbouring hill. All the other villages are in elevated and exposed situations.

In the town of Sandwich, which is completely surrounded by marshes, only a few isolated cases of diphtheria occurred, and in the villages on the marsh, viz., Sarr, Stourmouth, Monkton, and Minster, not a single case had been met with. This immunity of the marsh district is rendered the more remarkable by the fact that diphtheria has prevailed fatally on the high grounds which border it on either side,—on the south, at the village of Ash (2095) which is situated on a ridge formed by the outcrop of the lower tertiary strata, as already mentioned, and on the north at Birchington (885), a village having an equally favourable position on the chalky upland of Thanet.

In the greensand district from Ashford to Hythe cases of diphtheria have occurred in almost every village. Of those in which it has prevailed as an epidemic, Brabourn (816) and Stouting (237) are on the gault, Sellinge and Kennington (626) on light gravel, Ashford (4092), Chart (754), Willesborough (1022), and Kingsnorth (424) on sand or Kentish rag.

The other outbreaks were too limited to allow of any inferences being drawn from them as regards the influence of the conditions in question.

b. *Offensive Houses.*

I have made no observations which enable me to compare the frequency of diphtheria in houses in which the atmosphere is rendered offensive by defective drainage, overcrowding, bad ventilation, or uncleanliness, and in those which are free from these evils.

Crowle.—At Crowle, on making an inspection of all the houses of the poorer inhabitants, I met with these conditions in one street only, inhabited in great part by Irish immigrants. Of 14 families residing in this street, 10 of them containing children under 12, 3 only were attacked. All of the cases were mild, and exhibited the diphtheritic character indistinctly. In Pitholes the interiors of the houses were all clean and orderly.

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At Crazelound some of the houses invaded were offensive, others remarkably clean.

Launceston.—At Launceston the interiors were everywhere clean and free from smell.

Hanley.—In Hanley defects of drainage existed in all the houses I visited. In one of the localities in which fatal cases occurred, an open sewer extended along the backs of the dwellings in such proximity that the side of the sewer was formed by the walls of the cottages. In another street a row of cesspools occupied a similar position.

Hertingfordbury.—At Hertingfordbury the sanitary condition of the cottages was for the most part superior to that which is commonly met with in rural districts. They were in good repair and clean; none of them were internally offensive; the privies were provided with properly constructed cesspools, and separated from the houses by intervals of several yards.

Barton.—At Barton the cesspools are in the worst possible condition. The practice prevails of keeping their contents for long periods for agricultural purposes, to suit the convenience of the farmers. They are all above ground, and usually about six feet square, and frequently several are contained in the yard of one house, which are used in turn until all are full. I could not, however, ascertain that there was any difference between houses in which these nuisances existed and others, as regards the prevalence of diphtheria.

At Rothwell the number of cases was too small to admit of any inference being drawn.

Kent.—There was generally no relation whatever between the sanitary condition of the dwellings and the occurrence of cases of diphtheria. There were, however, some exceptions, which are worthy of note. Thus, at Kennington I found the cottages in a disgraceful condition, some being dilapidated, others overcrowded. In one which I examined (the first house invaded in the village), in which several cases and two deaths had occurred, I ascertained that a room six feet high and having a capacity of 750 feet, was at the time inhabited by at least six persons of various ages from infancy to adolescence. Many other cottages were in no better condition. The ventilation was also as bad as possible, the windows being of small size and incapable of being opened sufficiently. About half of the families attacked resided in cottages of this description. It was observed that some of the mildest cases occurred in houses with broken windows and dilapidated roofs.

At Ashford about half the mortality occurred in the families of mechanics employed on the works of the South-Eastern Railway Company. They inhabit a block of well but newly built cottages at a short distance from the town, on the right bank of the Stour.

c. *Previous occurrence of disease in houses in which Diphtheria prevailed.*

It was not found in any of the districts that the houses in which diphtheria occurred had been previously subject to any

other kinds of disease. When fever prevailed nine years ago in Crowle, Cross Street was the locality principally invaded. This street now contains 26 families and 44 children under 12 years of age. There were 16 cases of diphtheria, 9 of the sufferers by which were under 12; these were distributed in 10 families. Fatal outbreaks of measles had occurred some years ago at Westwoodside (Haxey) and at Llangore, near Launceston, in both of which villages diphtheria numbered many victims.

d. *Privation.*

It was found in all the districts that diphtheria exhibited no preference for any particular social condition, and that privation appeared to exercise no predisposing influence, persons enjoying affluent or comfortable circumstances not being less liable than others.

Axholme.—In the village of Crowle I ascertained that in 96 households invaded by diphtheria, 67 were of unskilled labourers, principally agricultural (including 3 families of paupers); 4 were of artizans, 15 of tradesmen, 7 of farmers, and 2 of gentry; and that in 151 cases, 96 occurred among unskilled labourers (6 paupers), 6 artizans, 28 tradesmen, 17 farmers, 2 gentry.

At Crazelound the first eight persons attacked were in affluent circumstances; the remaining cases were in the households of small farmers or agricultural labourers.

Launceston.—At Launceston, at the height of the epidemic, of 104 persons of all ages attacked, 3 were paupers, 6 servants, 24 unskilled labourers, 24 artizans, 6 tradesmen, 35 farmers, and 6 gentry.

Hanley.—At Hanley all the cases occurred in the families of persons employed either in the potteries or iron works.

Hertingfordbury.—At Hertingfordbury, with two exceptions, all the cases occurred among agricultural labourers or small farmers, these constituting almost the only class in the district.

Barton.—At Barton, of 17 fatal cases of diphtheria alone or complicating scarlatina, 3 were in the families of farmers, 4 of tradesmen, 1 gentleman, 9 of mechanics or labourers.

Rothwell.—At Rothwell all the cases occurred among persons engaged in agriculture; none were at the time suffering from privation.

Kent.—At Ashford no cases occurred among the gentry or tradesmen of the town, all the families invaded being those of mechanics or labourers; none suffering from privation. In answer to my inquiries on this subject I could not hear of any instance in which diphtheria appeared to be associated with poverty. It may be generally stated that the agricultural labourers of this part of Kent enjoy good wages and constant employment.*

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* The wretched condition of the cottages at Kennington, described in a previous paragraph, is not dependent on the poverty of the inmates, but on the determination of the landlord to diminish the number of cotters on his estate.

e. *Age, Occupation, &c.*

At Crowle, in 151 cases, 55 were in persons above 12 years of age, and 96 in children.

Of 104 persons attacked at Launceston, 21 were under 5 years of age; 13 under 10; 39 under 20; 24 under 40; 7 above 40.

At Hanley the greater number of persons attacked were under 10 years old.

At Hertingfordbury 6 only, out of 53 cases, occurred in adults.

At Ashford, among 67 cases, 53 were children less than 12 years old. Of 36 fatal cases which occurred at that town and in the neighbourhood, 13 were under 5 years of age; 13 under 10; 6 under 20; 5 under 40.

At Canterbury, in 62 cases, 13 were under 5; 21 under 10; 8 under 20; 18 under 40; 2 above 40.

At Goodnestone and the neighbouring villages, in 63 cases, 10 were under 5; 23 under 10; 22 under 20; 6 under 40; 2 above 40.

Of 195 cases in the district of East Kent, in which the sex could be ascertained, 112 were of females, and 83 of males.

In the other districts no sufficient information was gained respecting age, excepting that children were the principal sufferers.

No information was obtained as to the influence of occupation, habit of body or personal antecedents in increasing or diminishing the liability to contract diphtheria.

Previous attacks of Scarlatina.

Axholme.—In the district of Axholme, owing to the absence of scarlatina for some years previously, only one case was met with, in which it was certain that a patient affected with diphtheria had had that disease.

Launceston.—At Launceston it very frequently happened that households, all or most of the members of which had had scarlatina, were invaded by diphtheria; and it did not appear in any instance that those members of a family who had suffered from the former disease were less liable than the rest to the latter. Thus in a family of nine children, all under 14, two of whom had had scarlatina, four, including these two, contracted diphtheria. In another family, containing two children, aged 4 and $1\frac{1}{2}$, neither of whom had had scarlatina, the mother, who had suffered from that disease, took diphtheria, the children remaining exempt. The fact may be here mentioned as bearing on the same question, that during the recent prevalence of scarlatina at Jacobstowe, there were several instances in which that disease followed on convalescence from diphtheria. For example, a youth aged 22, residing in that village, had a severe attack of diphtheria, from which he recovered sufficiently to attend a fair at Wick St. Mary. While there he had rigors, and became so ill that he was removed home with difficulty. On the third day the eruption of scarlatina ap-

peared, and the disease ran its course with considerable violence. Another patient at Jacobstowe contracted scarlatina one month after convalescence from diphtheria. In both cases the characters of the two diseases were well marked.

Barton.—At Barton, where it will be remembered that scarlatina prevailed contemporaneously with diphtheria, but with much greater fatality, the experience of Launceston was confirmed, as *e.g.*, in the following cases:—W. H., aged 17, servant at a farm about three miles from Barton, contracted scarlatina anginosa on the 10th March, 1859, two of his family having previously had the disease, and another sister being attacked a few days later. He recovered favourably and returned to his work, but on the 21st of April he again complained of sore throat, which soon assumed the diphtheritic character, and terminated fatally on the fifth day. A. S., a boy aged 8, contracted scarlatina early in February 1859, consequently upon which he had hæmaturia and dropsy, accompanied with convulsions, a purpuric eruption, and rheumatic pains in the joints; on the 6th of March following he was attacked by diphtheria.

Kent.—In the neighbourhood of Ash scarlatina occurred occasionally during the prevalence of diphtheria, always, however, in a mild form. It never became complicated with that disease, and it often happened that children who had recently passed through scarlatina contracted diphtheria. Similar instances occurred at Wye and Sibertswold.

None of the medical men with whom I communicated in any of the districts had observed a single fact which seemed to indicate that scarlatina conferred upon its subjects immunity from diphtheria.

(For further information respecting the relation between Scarlatina, Measles, and Diphtheria, see Sect. VI.)

V. Communicability of Diphtheria.

a. b. *Distribution of Cases in Households.*

Although numerous instances were met with, in which all or the greater number of the inmates of considerable households were attacked by diphtheria in houses in which one case had occurred, it not less frequently happened that the disease affected single members of such households, or that its invasion was limited to a few individuals. These facts can be best exhibited in their relation to each other in the following tabular summary of the families in the district of Axholme which were visited by diphtheria.

TABLE II.

TABLE exhibiting the Number of Inmates eventually attacked in Families, in which a single Case of Diphtheria had occurred. The Table relates to Forty-two Families taken indiscriminately, including 106 cases.

Name.	Constitution of Family.		Age of Children.		Attacked.
			Youngest.	Eldest.	
Chapman - -	F. M.	3 children residing at home.	6	9	2nd.
Tankardly - -	F.	4 „	7	23	1st, 2nd, 4th.
Clark - -	F. M.	4 „	6	14	1.
Brunjee - -	F. M.	4 „	4	15	2.
[a] Staniforth - -	F. M.	7 „	14 m.	15	1, 6, 7.
Nicholson -	F. M.	5 „	3	10	1, 3.
Barratt - -	F. M.	5 „	7	19	1, 2, 3, 4, 5.
Wilson - -	F. M.	4 „	6	13	1, 4.
Linley - -	F. M.	2 „	5	8	F. 1, 2.
Mell - -	F. M.	4 „	5	14	1, 2, 3, 4.
Oughtabridge -	F. M.	6 „	2	14	3.
Pycott - -	F. M.	4 „	2	10	1, 2, 3, 4.
Sales - - -	F. M.	4 „	10	17	1, 2.
Walker - -	F. M.	5 „	8	26	3.
Thornton - -	F. M.	5 „	2	11	1, 2, 3, 4, 5.
Whitelees - -	F. M.	3 „	4	12	2, 3.
[b] Staniforth - -	F. M.	5 „	2	15	1, 4, 5.
Drinkald - -	F. M.	2 „	3	5	F. 2.
Proctor - -	F. M.	5 „	1	12	1, 2, 3, 4.
Scholey - -	F. M.	3 „	2	9	2, 3.
Earl - -	F. M.	4 „	3	19	3, 4.
Crittles - -	F. M.	3 „	2	12	2.
Pycott - -	F. M.	2 „	4	6	1.
[c] Staniforth - -	F. M.	4 „	9	19	1.
Jervis - -	F. M.	6 „	2	20	2, 3, 4, 5.
Lawrence -	F. M.	3 „	3	7	F. M. 1.
Wilson - -	F. M.	5 „	2	15	2, 3, 5.
Hodgson - -	F. M.	4 „	1	12	1.
Stones - -	F. M.	2 „	4	10	1, 2.
Maw - -	F. M.	3 „	3	7	M.
Cooke - -	F. M.	6 „	2	18	F. 1, 3, 5, 6.
Richardson -	F. M.	2 „	3	7	F.
Isle - -	F. M.	2 „	2	5	F.
Sinclair - -	F M.	3 „	1	4	F. M. 1, 2, 3.
Cave - -	F. M.	7 „	4	20	1, 3, 4, 6, 7.
Gillott - -	F. M.	4 „	2	9	1, 2, 3.
Easton - -	M.	4 „	2	8	1.
Jenkinson - -	F. M.	6 „	6 m.	11	1, 5.
Chafer - -	F. M.	4 „	2	20	1, 3.
Parkins - -	F. M.	5 „	3	14	4.
Scales - -	F. M.	5 „	2	10	1, 2, 3, 4, 5.
Adams - - -	F. M.	4 „	5	15	F. 1, 2, 3, 4.

The Table is to be read thus :—The family, Adams, consists of father, mother, and four children between the ages of five and fifteen years, of whom the father, and the eldest, 2nd, 3rd, and 4th children contracted diphtheria.

c. *Intervals between successive Cases in the same Household.*

When two or more cases occurred in succession in one household it very frequently happened, at Crowle, at Launceston, and in Kent, that there were considerable intervals between them. The following instances presented themselves :—

Name of Family.	1st Case.	2nd Case.	3rd Case.	4th Case.
Dowson - -	June 6	Aug. 1	—	—
Wilson - -	Feb. 6	Feb. 10	May 23	—
*a*Staniforth -	Jan. 3	Jan. 3	May 15*	—
Barratt - -	Jan. 27	4 other cases in May.		
Linley - - -	Jan. 30	Mar. 20	May 2	—
Wilson - -	June 25	July 10	Sept. 3	—
Pheasant - -	Sept. 21, 1858	July 24, 1859	—	—
Peak - -	Jan. 1	Jan. 18	May 15	June 1

* This patient had a second attack August 1.

d. *Repeated Attacks in the same Individual.*

Several remarkable instances were observed in which the same individual was attacked twice or more during the course of the epidemic. Thus, at Crowle, Eliza Jervis, æt. 4, was attacked February 23rd, contemporaneously with her brothers and sisters, and again singly on June 21st, more severely than before. J. S. Smith, æt. 9, first attacked December 25, 1858, again attacked in March following. The family Pycott consisted of four girls, æt. 10, 8, 5, 2, all of whom had diphtheria about the end of December 1858. The second was again attacked February 15, and died March 2. The third was attacked April 28, and died May 4. A young woman, æt. 25, residing at Camelford (Launceston), had diphtheria on the 25th of June, and again on the 14th of October, 1857. In both attacks the pellicular concretion characteristic of the disease was present. She had sore throat a third time without concretion on the 12th of January following.

The first case that occurred at Ashford was that of Mr. W. He was taken ill on December 15th, 1857, and a few days afterwards two of his children were attacked; all three recovered. Mr. W. was again attacked early in January 1859, diphtheria being at that time fatally prevalent in the town. On both occasions the disease manifested its distinctive characters, but the duration of the second attack was greater, and convalescence more protracted. G. S., a little boy aged 3 years, was taken ill on the 10th of March 1859, and recovered completely after a severe attack. On the 11th of April he contracted the disease a second time, and died on the 23rd. Instances altogether similar occurred in the experience of other practitioners.

I met with several other instances in which individuals who had suffered from sore throat contemporaneously with the occurrence of diphtheria in the households to which they belonged, were

subsequently attacked by that disease. It is to be noticed in all the above cases that the second attacks were more severe than the first.

e. *Personal Communicability of Diphtheria.*

The following are the only facts which I met with in the town of Crowle that appear to me to bear upon the question of the communicability of diphtheria by personal intercourse:—

Crowle.—Three of the families attacked at the commencement of the epidemic, Proctor, Staniforth *a*, and Staniforth *b*—are closely related to each other. The constitution of these families is shown in Table II.

Sarah Proctor, æt. 5, contracted diphtheria on the 13th December 1858, and died on the third day. Samuel, æt. 3, became ill about the same time, and died December 28th. James, æt. 12, who was away from home, was sent for to attend Samuel's funeral, and took the disease about January 11th 1859, but recovered. Mrs. Staniforth *b*, wife of Mrs. Proctor's brother, who resides in an adjoining cottage, nursed the children. The eldest Staniforth, a girl, æt. 15, took ill on the 10th of February, and two days afterwards her sister, æt. 2, who died February 22nd. Jane Staniforth, æt. 13, who not only assisted her mother in nursing the Proctors, but also attended to several other neighbouring families in which there were cases of diphtheria, was the only member of the family not attacked. On the 3rd of January two children, cousins of the above (Staniforth *a*) were attacked, and a third on May 15th. In this case there was no communication between the households, excepting that two of the children who remained exempt had been to see their cousins the Proctors in their coffins. The eldest girl, who took the disease four months after, waited constantly on her two sisters during their illness.

A little girl, æt. 7, daughter of Mr. L., farmer at Crowle, contracted diphtheria on the 12th of January 1859. On the 20th, M. C., servant in the family, was attacked, and subsequently two other members of the household. M. C. went home ill to Ealand, where no cases had occurred, but recovered. None of her family (including three children under 10) were attacked until the following July.

S. F., servant at the "Red Lion," contracted diphtheria April 9, 1859. She was removed to her brother-in-law's house, and died April 18. His four children, all under 11, remained exempt. During S. F.'s illness she was waited upon by her brother-in-law's mother, Mrs. W., who herself has a large family of children. One of these, æt. 14, took the disease April 18.

The family Sales consists of two daughters, æt. 17 and 15, and two boys, 12 and 10. The former, who waited on their cousin, Arthur Seaton, during an illness from diphtheria of six weeks, were both attacked shortly after his convalescence. The two boys were exempt.

The following instances are of more importance, as the individuals to whom they relate resided in isolated situations, and might, therefore be assumed to be beyond the reach of any means of communication excepting those ascertained:—

Daniel Cooke, æt. 18, servant in the farm of Eastoft Hall, contracted diphtheria on August 7. In this farm two cases had occurred in the family in the previous fortnight, and three of the servants were

attacked during the next few weeks. Diphtheria was also prevalent in the adjoining village of Eastoft. Daniel Cooke was sent home ill to Derrythorpe, which up to that time had been exempt from diphtheria. Four days after his arrival his sister, æt. 12, took ill, and recovered. Three days later a boy, æt. 5, and in four days more the youngest child, æt. 21 months, were attacked. The latter died September 3. On that day the father became ill, and exhibited the symptoms of diphtheria at the time of my visit (September 6). Two other children, æt. 9 and 13, were until that time exempt. These two slept in a very small room (5 ft. by 10 ft.), with one of those attacked, but not in the same bed.

J. Kelsey, æt. 9, contracted diphtheria on September 1, and died September 6. He was the son of a farmer whose residence is isolated, and far distant from any locality in which diphtheria had occurred. During the previous week the child had accompanied his mother on a visit to Westwoodside, where the disease was then fatally prevalent, but they were in no house in which there were cases.

Mrs. Stone, wife of a labourer on Mr. Arnew's farm, Sandhill, was seized with premonitory symptoms on July 11th. On the following day her throat became sore, and a few hours after the diphtheritic concretion was observed. Her husband first complained of sore throat on the same day. The characteristics of the disease were marked in both cases. No other case had occurred at that farm or in the neighbourhood. Richardson, bailiff of the same farm, who resides in a house at some distance from Stone's Cottage, was attacked on July 22d. He has two children, under 7, both of whom, and their mother, remained exempt. There was no other case on the farm. Mrs. Stone had not been absent from home, and no possible means of communication with persons suffering from diphtheria, could be discovered.

The families, Lister and Isle, reside in two adjoining cottages about a mile distant from Arnew's farm, and as far from the nearest houses. The Lister family consists of the parents and two youths, æt. 20 and 13. The younger was attacked June 17th, the elder June 20th, the mother on the 23d. The Isle family includes two children, æt. 5 and 2, both of whom remained exempt, but Mrs. Isle was attacked six weeks later than Mrs. Lister.

Mr. Sinclair, a farmer residing at Triangles, no cases having occurred in the neighbourhood at the time, contracted diphtheria on the 12th October 1858. On the 8th he had been to a village many miles distant to see his brother who had shortly before lost his wife by that disease. There was no one in the house suffering from diphtheria, but it prevailed in the village. On the 15th Mrs. Sinclair was attacked, and on the following day their eldest child, æt. 7, who died on the 29th. Some days later the second child, æt. 4, was taken ill, and died November 6th.

In the village of Eastoft, in which subsequently there were numerous victims to diphtheria, the first cases occurred May 20th, 1859; two children in one family (Tile), were attacked, but recovered. M. A. Sampson, æt. 6, the next child affected, became ill on July 1st. and died on the 9th. A few days after his brother George contracted the disease, and died on the 25th. In another week a pauper family named Cave, consisting of seven children, was invaded. There were four cases and three deaths, all of which happened between the 4th and 24th of August, after which time a number of other cases occurred in different parts of the village. The families Tile, Sampson, and Cave resided at a distance from each other and had no communication.

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Anna Cave, æt. 20, was in service at Crowle, and contracted diphtheria June 5th. I saw her on the 7th ; she was reported well on the 12th. She then went home for a short time to Eastoft, but did not communicate the disease to her brothers and sisters, who were not attacked till six weeks later.

In the village of Luddington, Mrs. Shincliffe, who had had no communication whatever with cases of diphtheria, none having previously occurred in the village, contracted the disease March 12, 1859. There were children in the family, but none of them were attacked until the following August. The second case, which was fatal, occurred May 17th, and the third on June 1st, the fourth on the 13th, and the fifth July 1st, after which the cases became frequent. There was no communication between the first four individuals attacked, and they were all in different families.

The first cases at Garthorpe occurred in the family Gillott, consisting of the parents and four children, æt. 9, 7, 4, and 2. The eldest was attacked July 29th ; he soon became convalescent, but had a relapse about August 15th, and died September 7th. The second was attacked about September 1st, and the third September 5th. There had been no communication between the Gillots and any individuals affected with diphtheria. It was alleged, indeed, that Ann Garland, a member of a neighbouring family, and then in service at Crowle, in the house of Mr. Wilson, whose children had recently had diphtheria, imported the disease into the village. I found, however, that she was sent home ill August 18th, that is, some days after the eldest Gillot relapsed. Up to the date of my visit (September 7) two other families had been invaded at Garthorpe. They resided at a considerable distance both from each other and from the Gillotts.

At Crazelound the first cases occurred in the family of Mr. T., a substantial farmer, in February 1859. Two children, their governess, and the parents were attacked in succession. On March 1st they were all convalescent, when Mr. T.'s sister-in-law, who resided in a detached house at some distance from the farm, and had rigidly avoided communication with her nieces, contracted dipththeria, and died on the 7th. Her sister and Mrs. Bouskill, the nurse who attended her, both contracted the disease, and on the 12th the little girl of the latter (æt. 8) took ill and died on the 18th. The next two cases were in cottages close to the farm, the inmates of which, however, had no communication with the family. They occurred on May 15th and 21st, after which dates the disease prevailed in the hamlet with great malignity.

Mrs. Burton, an inhabitant of Burgewallis, near Doncaster, where up to the time in question, there had been no cases of diphtheria, came to Crowle with her child aged two on May 25th. During her stay she slept in a house in which a patient was then reeovering from diphtheria. Her child was attacked June 2d ; I saw her on the 6th ; she was convalescent on the 11th. Two other instances came under my notice in Crowle, in which children brought into the village from localities free from diphtheria were attacked within a fortnight after their arrival.

The following instances occurred in Kent :—

Elizabeth W., æt. 22, a servant, residing at Great Chart, who had twice before been under treatment for diphtheritic sore throat, manifested the disease in a more severe form, January 5th, 1860. On the 9th she was sent home to her parents at Bethersden, and

died on the 12th. No cases of diphtheria had at that time occurred at Bethersden for eight months.

Agnes W., sister of the above, æt. 6, became ill on the following day, the 13th, and died on the 21st. On the 3rd of February Edward K., a boy æt. 9, of strumous habit, who had for some time suffered from chronic enlargement of the tonsils, contracted diphtheria. This child was not resident at Bethersden, but came to the house of the W.'s after the death of the elder sister. He died on the 10th of February. Death was preceded by intense dyspnœa, believed to be rather faucial than laryngeal. No other cases are known to have occurred at Bethersden in 1860.

At Monkshorton 10 cases of diphtheria occurred; the first was that of a little boy who until a few days before his attack resided at Horton Court. He was then convalescent from hooping cough, and was brought for change of air to an isolated farmhouse situated on the northern slope of a hill near Horton Priory. A few days after he arrived he contracted diphtheria, and died on the sixth day of his illness, June 22nd, 1859. The family at Horton Priory consisted of father, mother, and six children of various ages from 8 to 17. About the same time that the little boy above mentioned came under treatment, the second daughter, æt. 14, was taken ill. She was at first supposed to be suffering from a common cold, and was not placed under medical care until the 21st. When seen on that day she had a patch of concretion on one tonsil. The case was marked only by its long duration, successive crops of concretion being formed and re-formed for a fortnight. On the 22nd two other children were taken ill. One of these was apparently approaching convalescence, when on the 28th symptoms of extension of the concretion to the air passages unexpectedly manifested themselves, and on the following day the patient died. The other child recovered. The three remaining children and the mother were not attacked until nearly ten days after the first death. They also recovered. As soon as they were convalescent the three elder surviving girls were removed to the houses of neighbours, who resided on the crown of the hill (about 250 yards distant), it being supposed that their house was unwholesome. Of the three families into which these patients were introduced, two consisted of adults only, the third of the parents and two girls of the respective ages of 19 and 11. Ten days after M. S. had been received into this family the younger daughter was attacked and in a few days died. The elder girl, in service, who came home to nurse her sister, also took the disease, but recovered. No other cases occurred in the village.

The only cases which occurred at Sellinge were the following:— Until March 1860 Mr. and Mrs. Y., with their son and his wife and their own three children, the youngest of whom is 7 years old, the others 10 and 12, resided in one house. At that time the two families separated, and they now live about a mile apart. On the 1st of April last the second child, æt. 10, was attacked, and died on the 3rd. The youngest was taken ill on the

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7th and was seen by me on the 8th. The son's wife, who nursed her sister-in-law, and returned to her own house on the death of the latter, contracted the disease on April 4th.*

At Adisham a family of six children, the eldest æt. 16, the youngest 4, all contracted diphtheria within twelve days of each other. In these cases the disease assumed a special character which is worthy of notice. The case of the eldest girl, æt. 15, (communicated by Mr. Kersey) who was first attacked, may be taken as an example. It exhibited at its outset the ordinary aspects of diphtheria. Very firm concretions covered the fauces, which were repeatedly removed and reproduced. The patient progressed favourably until the sixth day, but from that time she changed for the worse. On the following day there was complete prostration, the external swelling, before inconsiderable, increased so enormously as to obliterate the hollow of the neck. There was also increased swelling of the fauces, the mucous membrane assumed a livid hue, and the half-detached and discoloured concretions were bathed in an abundant and horribly fœtid discharge, so that the whole fauces resembled a slough. In two days after the commencement of the swelling she was dead. In the brother, æt. 16, the septic stage was preceded by an equally distinct concretionary stage, and in this case death seemed to be accelerated by the interference with respiration dependent on the external and internal swelling. The process was so rapid that he walked to the surgery and back, a distance altogether of five miles, only two days before his death. The youngest child, a boy æt. 4, contracted diphtheria and apparently recovered, but suddenly refused food, complained that he was ill, and was dead before he could be seen by Mr. Kersey. The rapid progress of the disease in these cases was such that the last of the six children died 14 days after the eldest girl was attacked.

There was no eruption in any of these cases, and Mr. Kersey is strongly of opinion that scarlatina was not present. Two imported cases of that disease were at the time under treatment in the village. No other cases of diphtheria have occurred.

The only cases at Wingham were at a farmstead in the neighbourhood of that village, known as Wingham Hill. Eight cases succeeded each other in four weeks, among the servants of the farm or their families, as follows:—

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* Since the above was written two other cases of diphtheria have occurred in the same household. A daughter, æt. 17, a robust young woman, in service at Postling, where there has hitherto been no diphtheria, returned home in perfect health on Sunday, April the 8th. On Saturday the 14th she was first seen by Mr. Pittock, of Sellinge, who reports that "the diphtheritic exudation was already very extensive, "covering the tonsils and arches of the fauces on both sides." During the next few days the concretions extended, and were successively reproduced after removal; but on the 18th the condition of the fauces was improved, the concretions had for the most part separated, leaving considerable loss of substance of the tonsils and posterior arches, and the dyspnœa which had before existed was diminished. On the following day she became suddenly worse, and at the next visit was dead. The other child, James Young, aged 12, was attacked on the 21st of April; the disease in this case ran a milder course, and the boy is fast getting well (30th April).

July 26. W. B., æt. 5, son of a farm servant, died Aug. 5.
Aug. 4. Mrs. B., mother of above, recovered.
„ 5. M. A. B., her daughter, do.
„ 8. F. S., niece of Mrs. B. and residing in the same cottage, recovered.
„ 10. A. B., æt. 1½, another child of the same, recovered.
„ 10. T. M., æt. 14, farm servant, boarded at the B.'s, but slept at the farm, recovered.
„ 22. S. M., æt. 17, sister of above, servant at the farm, recovered.
„ 22. T. F., labourer on the farm, recovered.

At Goodnestone the whole number of cases (24) occurred between June 29th and September 2nd, 1859. Thirteen of these came under treatment during the first ten days of the outbreak. These were distributed in nine households, of which two resided under the same roof, and three others in neighbouring cottages.

The following isolated group of cases presented itself near Barham:—1. A family, consisting of father and mother, five daughters, and two sons, five of whom were adults, residing in a hamlet previously exempt from diphtheria, was invaded as follows; the eldest daughter was attacked Dec. 22nd, 1859, the second daughter and the eldest son on the day after, the remaining members of the family on the two following days. The two sons above mentioned had returned from London on the 22nd, where they were pursuing their studies, so that they had been exposed to the epidemic influence for three days only. Several of these cases were of considerable gravity, but all recovered.

Inferences from the above Facts.

From the attentive consideration of the instances above related, all of which occurred in the districts of Axholme and East Kent, it appears—

a. That when an individual suffering from diphtheria was introduced into a locality in which no cases had before occurred, the disease frequently extended to those residing under the same roof, but rarely to neighbouring households; but the danger of infection incurred by persons residing under the same roof with a patient thus introduced did not seem proportionate to the intimacy or frequency of their communication with him.

b. That the transference of the disease from one place to another was in some instances determined by local proximity, but that in those cases in which it was not so—that is, in cases in which the disease appeared for the first time in a locality distant from any in which it had previously existed—the circumstances were frequently such as to shut out even the possibility of personal communication.

Hence the conclusion is unavoidable that, unless it be supposed that the material cause of diphtheria is from time to time generated *de novo*, it is capable of existing and moving from place to

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place independently of its subjects. It may also be inferred, though not with certainty, that it is capable of remaining for a time in a house or limited locality without affecting the residents. This is rendered probable by the instances in which children brought into diphtheria neighbourhoods were shortly afterwards attacked; although they had not come into relation with any one suffering from the disease. Such also seems to be the explanation of those instances in which one case occurring for the first time in a house or hamlet, is followed by a second only after a long interval.

In most of the districts the epidemic area was remarkably circumscribed. At Axholme it invaded village after village, at long intervals. In Kent as well as in Cornwall and Devonshire certain villages were singled out by the disease, while others similarly situated, and at a short distance, remained exempt. At Rothwell, all the cases occurred in one village or its immediate neighbourhood.

Co-existence of Scarlatina and Diphtheria in the same Houses.

I met with the following instances of the concurrence of the two diseases in the same houses, and at the same time.

1. In a boarding school in the town of Launceston (containing thirty boarders) a series of six cases of diphtheria occurred, not attended with eruption, the first on October 3d, 1858, the last on October 26th, three of the children attacked being in the family of the master. On October 11th, a little boy, æt. 8, of the same family, contracted scarlatina, which ran its course in a characteristic manner, and was followed by albuminuria and dropsy (see Sect. VI.).

2. In the family Clark, at Barton, consisting of five children under 15, four contracted scarlatina in succession. In the first two cases, those of the eldest and third children (æt. 12 and 8), the attacks were severe, but the disease assumed its ordinary characters. In the third case, the symptoms were exceedingly mild until the commencement of desquamation, when the throat became worse, the case assumed the characters of the new disease, and terminated fatally. The second and youngest children remained exempt.

3. The family L., at Brabourn, consists of the father, mother, and three children, aged 9, 4, and 2 years. The eldest boy was attacked on March 26th, 1860, and the others in succession afterwards. In all, the characters of diphtheria were well marked, the concretions being most abundant in the eldest. In the youngest boy convalescence had scarcely been established when febrile reaction set in, which was followed by the eruption of scarlatina. In the meantime the eldest, who had been convalescent from diphtheria for a week, manifested symptoms of the other disease, which ran its course mildly, and was followed by desquamation. In neither instance was the scarlatina accompanied with any aggravation of the local affection.

There were other instances in which sore throat without eruption, and exhibiting more or less distinctly the characters of

diphtheritic pellicular concretion, occurred consequently or intercurrently, in the same houses with series of cases of scarlatina.

The following are the only instances I have heard of in which pure diphtheria (employing the expression as applicable to a case having the characters of diphtheria exclusively) coexisted in the same house with *pure* scarlatina. The first of them was related to me by a practitioner, on the accuracy of whose observation the greatest confidence may be placed.

A little girl, æt. 4, residing at Deal, contracted scarlatina about December 15th, 1859, and recovered. On the 2d of January she was attacked by faucial diphtheria. On the third day the symptoms of extension to larynx manifested themselves: she died on the day following. In the meantime her brother, æt. 7, was taken ill with scarlatina, and died about the 7th. The two diseases retained all their characters unmodified by each other. (Mr. Hulke.)

In a hamlet near Ash the following group of cases presented themselves. A family of six children was invaded by scarlatina, three of whom were attacked almost simultaneously. Three days afterwards one of the other children contracted diphtheria, and subsequently the remaining two. Neither of the three last exhibited the eruption or any other symptom of scarlatina. They all recovered. In the adjoining cottage, under the same roof, inhabited by a family of seven children, all contracted diphtheria, and four died, none exhibiting the characters of scarlatina. The first of these cases occurred while those of the former family were still under treatment.

VI. Symptoms of Diphtheria.

a. *Character of the Diphtheritic Concretion.*

As regards the consistence of the diphtheritic pellicle, there was considerable difference between the cases at Launceston and in Kent and those observed in the other districts. In the former it was tough, leathery, and highly elastic; and on the mucous surface of the fauces and pharynx it attained so great a thickness (from one-tenth to one-eighth of an inch), that it was compared by several practitioners to the coriaceous lichens which grow on rotten bark. In the other districts this was never observed. At Crowle the concretion was usually soft, and not thicker than soaked parchment; it possessed so little toughness or elasticity, that it could only be detached in shreds from the mucous surface. In some cases, however,—those in which its extension was most rapid,—it attained much greater firmness and tenacity, and a thickness of about one-twentieth of an inch. The only *laryngeal* concretion I had the opportunity of seeing at Crowle, was firm and elastic. At Hertingfordbury, and at Barton, the concretion possessed the same characters as at Crowle.

The firm coriaceous concretions met with at Launceston,

whether faucial or laryngeal, exhibit, when examined microscopically, the appearance of an intricate reticulum of interlacing fibres, in the substance of which cell-forms may or may not be embedded. In the *firm* concretions observed at Crowle, the same appearances presented themselves; but the soft and friable pellicles, most common there and elsewhere, possess a totally different structure; they consist always of nucleated cells (the membrane of which can only be made out when the product is fresh), embedded in a granular or amorphous, but not fibrillated substratum.

As regards the extent of the concretions, there were also notable differences between the districts visited. At Rothwell the pellicle never extended, even in fatal cases, beyond the tonsils and uvula; and in some of great severity it was confined to one tonsil, on which it formed a patch, not larger than a farthing. There were no similar examples in the other districts. In some instances the concretion covered the whole of the mucous membrane of the fauces and pharynx, so far as it could be explored; in others it extended to one side only, but it rarely happened that one tonsil only was affected.

b. *Ulceration.*

Launceston.—From the very careful inquiries which I made at Launceston, and the general agreement among the practitioners, I am led to the conclusion that in that district diphtheria was primarily attended with ulceration. I found the inference, on the general occurrence of ulceration, in almost every case at the acme of the epidemic,—on the occurrence of numerous cases in which ulceration existed without concretion,—and, lastly, on the fact that the ulceration was often not conterminous with the exudation and sometimes preceded it. The first two facts rest on the independent testimony of Messrs. Thompson, Wright, and West, at Launceston; the third, I myself had the opportunity of verifying, in a case which I saw there; and the last is derived from notes made at the time by Mr. Thompson, whom I know to be a most capable observer.

The parts most liable to ulceration are the tonsils, velum, and the folds of mucous membrane which stretch from that structure to become continuous with the pillars of the fauces. The ulcers always presented the characters of a white or ash grey excavation, surrounded by a slightly prominent margin of a deeper colour than the adjoining mucous membrane. The ulcerative process was often associated with softening of the tonsil, the whole or part of the glandular structure being eventually converted into a pulpy mass. The reality of this change was proved by several facts, the observation of which could not be mistaken. In one instance in which the tonsil was soft, swollen, and livid, an ulcer existed on its anterior aspect. On applying the caustic to this ulcer, it passed without resistance through the mucous membrane into a cavity in which its point could be freely moved in all

directions. In other cases a similar condition existed along with more extensive destruction of the mucous covering of the gland, and in these the reality of the resulting loss of substance was proved by the condition of the parts after convalescence, when, as I had good opportunities of satisfying myself, no trace whatever of the tonsil was left. The extension of the ulceration from the tonsil to the posterior pillar of the velum occurred frequently. In one instance a permanent perforation of that structure resulted about a third of an inch in width.

Rothwell.—At Rothwell, where ulceration was a feature of all the severe cases, its characters resembled those already described. It is, however, to be noted that here the ulceration took place beneath the concretion, and only became visible on its separation. Of three severe cases, of which I was furnished with notes, ulceration was observed at the first visit, and had already made progress. In the third it was first seen on the spontaneous detachment of the exudation on the sixth day. In the most marked case "the tonsil itself and the arch of the velum were destroyed, so that there was a continuous sloughy surface from the position of the tonsil to the pharynx." At Crowle I had no opportunity of seeing any case of ulceration; it was met with, however, in a limited number of instances. I saw two examples of perforation of the kind I have mentioned; one of the anterior pillar of the fauces, the other of the velum; in either case large enough to admit the passage of a quill.

The mucous surface covered by the exudation always presented in the absence of ulceration an excoriated appearance, resembling that of a blistered surface. After the detachment of a concretion, I have usually observed the red and somewhat roughened area to which it was adherent distinctly mapped out.

In Kent, where the pathological manifestations of the disease closely resembled those observed in Cornwall, ulceration was met with in all the localities in which diphtheria numbered many victims. Permanent results of ulceration exist both at Littlebourn and at Goodnestone in which the arches of the velum, the uvula, or the tonsils, are partially or entirely destroyed. I have already referred to cases which occurred at Adisham and Beakesbourn (p. 27), in which diphtheria assumed a character closely resembling that of the angina gangrenosa of authors, both in the rapidity of its progress to a fatal result, and in the apparently sphacelated condition of the fauces. I had, unhappily, no opportunity of seeing any of these cases, and no post-mortem examination was made.

Formation of successive pellicles.

In respect of the reproduction of the concretion after spontaneous or artificial separation, great differences were observed, both in the epidemics and in individual cases. It was, however, generally found that the renewal of the pellicle on the same mucous surface was most rapid, and repeated the greatest number of times in those cases in which the tendency to extension was

greatest. Thus, while at Rothwell it was not even ascertained that the pellicle was renewed at all, at Launceston and in Kent, where extension to the air passages was frequent, it was re-formed very rapidly. At Crowle I had the opportunity of seeing an example of extreme rapidity of reproduction of faucial and pharyngeal concretion; and I have notes of a similar case in a robust adult at Hertingfordbury, watched with the greatest care and attention, in which on some of the mucous surfaces the pellicle must have been renewed from twenty to thirty times in the course of the three or four weeks during which the process continued.

c. *Extension of Diphtheritic Pellicle to the Mucous Membrane of the Nose.*

The signs which indicate the participation of the mucous membrane of the nares in the disease are obscure and uncertain. I have directed my inquiries to the occurrence of coryza at the outset, to the subsequent discharge from the nostrils of fœtid quasi-purulent fluid, to the occlusion of those passages by concretion, and to the repeated occurrence of epistaxis, to all of which symptoms importance has been attached in this respect.

One case was recorded at Hertingfordbury, in which the outset of diphtheria was preceded for a week by coryza, but no similar instance was met with in any of the other districts. Fœtid discharges were observed everywhere, and at Hertingfordbury there were cases in which these contained shreds of concretion. Epistaxis was observed at Crowle, Haxey, Hertingfordbury, and Barton. At Crowle it occurred in six of the fatal cases, in several of which it appeared to have considerable influence in determining the result.

In Kent there were several instances in which death was preceded by repeated attacks of hæmorrhage from the nares and fauces. It was often, however, difficult to determine its source. In one instance which occurred at Sibertswold there was a profuse discharge from the nostrils, containing membranous concretions, and similar concretions were adherent to the nares, and could be detached in large laminæ. This condition lasted for a fortnight after the affection of the fauces had disappeared.

Extension to the Mucous Membrane of the Larynx.

Proof was obtained of the extension to the larynx in cases which occurred at Crowle, Haxey, Launceston, and Hertingfordbury. Cases in which death was preceded by suffocation were also recorded at Hanley. At Crowle there was one case only in which casts of the trachea and bronchial tubes were obtained; I have no means of determining in how many instances the symptoms of laryngeal concretion existed; it is certain, however, that they bore a small proportion to the fatal cases. At Launceston, on the other hand, out of twenty deaths of which I have information, in the practice of Mr. Thompson, it appears that eighteen were preceded by the symptoms of croup, in five of which

the evidence was confirmed by the expectoration of casts. At Hertingfordbury, the existence of laryngeal exudation was determined in one case by post-mortem examination, in another by symptoms. At Barton, the symptoms of laryngeal obstruction occurred in two cases, in one of which the diagnosis was verified by post-mortem examination. At Rothwell, they were observed in one case consequently on faucial concretion, and in three fatal cases without exudation. It is to be observed, relatively to these last, that idiopathic croup is endemic at Rothwell, and that they did not resemble in character the cases of diphtheria which occurred at the same time.

In Kent, death was in many cases preceded by the signs of laryngeal obstruction. Proof was obtained of the existence of concretions in the air passages at Eythorne and Canterbury by the expectoration of tubular casts,—at the former place by post-mortem examination, and at Deal by the performance of tracheotomy.

Extension to the Mucous Membrane of the Æsophagus.

This appears to have occurred in the following instances communicated by Mr. Maund of Ashford :—

J. S. having been much exhausted by nursing his wife and three children, who were all ill of diphtheria, himself contracted the disease, December 29th, 1858. The disease assumed its ordinary characters, and he was convalescent in a week. A few days afterwards he complained of difficulty in swallowing, and extreme muscular weakness. Stimulants were energetically administered; he had a bottle of champagne daily, and brandy and milk ad libitum. He became more and more unable to swallow until the act was entirely impossible. Milk and brandy were then introduced by the rectum, but on January 27th, 1859, he died.

J. M., a schoolmaster at Ashford, contracted diphtheria in December 1858. He had extensive faucial concretions, which were continuously reproduced for ten days. About that time he began to suffer from dysphagia, and some days after discharged a tubular cast, which, as there had been no dyspnœa, was assumed to have been derived from the æsophagus. The difficulty of swallowing increased, and on the fourteenth day after the first appearance of the symptoms he died.

d. *Adenitis.*

At Crowle and Haxey, pain and swelling of the sub-maxillary glands, and of the surrounding cellular tissue, were observed in various degrees. In two cases the cervical tumour was enormous, and eventually suppurated after the subsidence of the diphtheritic affection. Both of them terminated fatally, the result being appa-

rently immediately attributable to the exhaustion consequent on suppuration.

In Kent, as in the other districts, it was generally true that in mild cases of diphtheria, and in those which terminated fatally by croup, adenitic swelling was one of the most variable of the phenomena of the disease; but that whenever it assumed the malignant character described in the cases at Adisham (p. 27), enormous swelling, extending not only to the sub-maxillary glands, but to the cellular tissue of the neck, was constantly observed. In these cases the rapid increase of the external tumour was the most obvious, if not the first of the succession of alarming symptoms which immediately preceded death.

e. *Febrile Excitement.*

The invasion of the disease was almost always attended by febrile excitement, usually ushered in by slight rigors. The reaction as evinced by the heat of the skin was not comparable in violence to that which is commonly met with in scarlatina, or even in any of the other pyrexiæ; and it was invariably observed that it differed from that which accompanies those diseases in the rapidity of its subsidence. There was great difference between the cases, both as to the intensity and persistence of fever. At Crowle it is recorded, that at the beginning of the epidemic several cases occurred, rapidly fatal by exhaustion, in which it was entirely absent; but for some time previous to my visit, none of the kind had been met with. At Launceston the absence of the obvious signs of fever was also observed in some instances, which terminated unfavourably. At Hanley, out of six severe cases, in which the condition of the patients at the onset is noted, there was marked febrile reaction in four. Of the other two, the subjects of which were adults, there was slight fever in one, while in the other all the signs of pyrexia were absent. The results of my inquiries at Hertingfordbury coincided with those obtained at Crowle. At both places I had the opportunity of verifying the concordant testimony of practitioners on this point, by the observation of cases which subsequently terminated fatally, and in which marked pyrexia was present at the onset. In Kent I met with several exceptional instances in adults in which the first complaint of sore throat was preceded for a day or more by symptoms resembling those which usher in the graver fevers. In one case of a gentleman in robust health and of middle age, this preliminary stage lasted three days. It was introduced by marked rigors, followed by intense headache, complete anorexia, sleeplessness, and an extreme degree of restlessness, so that the patient could neither sit nor lie. Until the third day he was not conscious of having sore throat; it was then found that the diphtheritic concretion had already extended considerably on either side of the fauces. I have met with no other case in which the preliminary stage lasted more than thirty-six hours.

Constitutional State preceding Death in Diphtheria.

In ordinary severe cases of diphtheria, excluding those in which the symptoms dependent on laryngeal obstruction were met with, the constitutional state preceding death was marked by pallor and coolness of the skin, progressive acceleration of the pulse, which became *pari passu* weaker, and finally imperceptible, dejection of the expression, extreme muscular weakness, and a condition of tranquil drowsiness more apparent than real, with complete integrity of the intellectual faculties. The occurrence of delirium even at night was unusual. This was the dominant aspect of the fatal cases at Crowle and Haxey, Hertingfordbury and Barton.

In Kent, in those cases which terminated fatally in the acute stage, death happened either by croup or by prostration, as above described. Different cases of the latter class seemed only to differ from each other in the rapidity with which the result was brought about,—in some at the close of a gradual decline of a week or ten days, in others, in a few hours; in either variety the absence of any symptoms, excepting those which have been enumerated, was equally remarkable. In those patients who eventually died by croup, it often happened that up to the moment of the alteration of the musical tone of the voice and cough, which usually affords the earliest indication of the commencement of exudation in the larynx, the case had appeared to the practitioner to be free from danger. The following is one of many examples related to me. Two children, æt. 11 and 9, were first seen, June 22, 1859. On examining the fauces, concretion already existed on either tonsil, which on the succeeding day had extended to the soft palate, and, in the case of the elder sister, covered the uvula. Both patients progressed equally favourably until the sixth day, when it was observed that the voice of the elder child had become "singing," and that the pulse was somewhat accelerated. On making her cough the same alteration of tone could be distinguished, but there was no dyspnœa. During the night the breathing became difficult, and continued increasingly so until she died. Death was preceded by a condition of tranquil drowsiness, from which she could be easily roused. The other child made a good recovery. I could not hear of a single instance in Kent in which paroxysmal exacerbations of dyspnœa, accompanied with jactitation or cyanosis, were observed in laryngeal diphtheria.

f. Albuminuria.

Albuminuria was met with in the districts of Axholme, Launceston, Hanley, and Hertingfordbury. At Barton and Rothwell no observations had been made, and in the other districts the condition of the urine had not been recorded in a systematic or continuous manner. At Crowle albumen was frequently found, but in some severe and fatal cases it could not be discovered. At Westwoodside observations were made during three months, from which it appeared that albuminuria existed in all the well-marked

cases. At Hertingfordbury the urine was albuminous in all the cases in which it was examined excepting one.

g. Complications.

There were no cases in which it appeared that diphtheria was complicated with any internal inflammations, excepting those of the mucous membranes.

The following appeared to be an example of a diphtheritic form of dysentery:—

An isolated farmhouse between Dover and Canterbury was invaded early in January 1860 by diphtheria. The household then consisted of the parents, three children, aged respectively nine, five, and three years, their governess and three servants, all of whom were taken ill in rapid succession. The youngest child was attacked first and died; there were faucial concretions, and the signs of laryngeal obstruction already existed when she was first seen. Soon after her death the other two children complained of sickness, muscular pains, and other symptoms, which were followed, not by an affection of the throat but by diarrhœa. This increased in spite of treatment for several days. On examining the stools, of which there were 15 or 16 daily, they were found to consist mainly of membranous concretions, mixed with blood and mucus. Small doses of castor oil were administered alternately with opiates, and subsequently the tincture of the sesqui-chloride of iron. Both children recovered. I have notes of several other cases in which diphtheria has been followed by protracted diarrhœa with a fatal result.

h. Consecutive Muscular Weakness.

In a certain proportion of cases the patient passed from the condition described in paragraph e. into another, in which all constitutional symptoms were absent excepting extreme muscular weakness and anorexia. This was well illustrated in the case referred to at the end of par. b., in which the formation of successive concretions was continued for several weeks. The onset was marked by febrile excitement, which very rapidly passed off, the pulse sinking in the first day from 120 to 80, and never again rising. The condition of the patient in every other respect, excepting his extreme weakness, was that of health. He ate, slept, studied, and lived as usual; and, although he took enormous quantities of alcoholic stimulants, the circulation never became excited. There were no instances in which this condition appeared to be attended with danger in adults, but in children it was frequently fatal, probably owing to the extreme difficulty of administering food.

In some cases it became permanent, and was then accompanied by functional nervous disorder. The following is a summary of the most prominent symptoms observed in these cases:—

TABLE III.

TABULAR SUMMARY of Symptoms observed in Nine Cases of Functional Nervous Disorder, consecutive on Diphtheria.

Name.	Age.	Condition.	Place.	Characters of Acute Attack.	Muscular Movement.	Sensibility.
Mrs. T.	40	F. M.	Crowle -	Faucial concretions repeatedly renewed, and very extensive ulceration, with loss of substance. Duration, 4 w.	At first, paralysis of lower limbs and impaired motility of upper; gradual improvement, but long persistence of inability to direct movements.	At first anæsthesia; subsequently tingling and other abnormal sensations in hands and feet. At first blindness; subsequently indistinct vision.
E. R. -	15	F. S.	Luddington	Faucial concretions, very extensive ulceration. Duration, 3-4 w.	Partial paralysis of lower limbs. Regurgitation of liquids in swallowing.	Common sensibility, normal. Indistinct vision.
M. C. -	10	F. S.	Egliskerry -	Do. do. Duration, 3 w.	Marked impairment of motility of upper and lower limbs, most of the latter. Articulation resembling that of a person suffering from deficiency of palate. Regurgitation.	Impairment of vision and deafness.
A. E. -	8	M. S.	Ealand -	Faucial concretions existed 9 days. No ulceration noted.	Impairment of motility and directing power of lower limbs. Articulation as above. Regurgitation.	Impairment of vision and diplopia, lasting several weeks.
Mrs. S.	35	F. M.	Crowle -	Concretions, extensive, existing 3 w. No ulceration noted.	Lower limbs as above. Regurgitation.	Impairment of vision.
R. C. -	18	M. S.	Crowle -	Duration, two weeks. Second attack.	Complete paralysis of lower limbs. Regurgitation.	Normal.
J. D. -	35	M. M.	Goodnestone	Very extensive faucial concretions. Duration, 2-3 w.	No loss of muscular power, but inability to perform combined movements with fingers.	Perversion of sensibility of hands and feet, numbness and tingling.
—	8	M. S.	Deal - -	Intense erythematous pharyngitis, with very limited concretion.	Normal - -	Impairment of vision; strabismus and diplopia.
J. H. -	11	M. S.	Ashford -	Faucial concretions, but not extensive. Duration less than a week.	Normal - -	Impairment of vision.

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It is worthy of note that in none of the cases of impairment of vision did the affection present itself during the acute stage, and that there was usually a considerable interval of complete convalescence. In the last case, that of J. H., nothing was observed until three weeks after he was supposed to be well. As regards the nature of the affection, the following observation made by Mr. Whitfield on this patient is interesting. With the aid of glasses suited to a person of 80 or 90 he was able to read the smallest print easily, although he was unable to distinguish the largest unassisted. He could see much more distinctly at a distance than near. From this it would appear as if the impairment of vision were, at all events in some instances, dependent rather upon an alteration in the density of the media of the eye than on impaired innervation.

Diphtheria as a Complication of Scarlatina.

At Launceston and Barton, and in those localities in Kent in which scarlatina prevailed simultaneously with diphtheria, it was frequently complicated with it; that is, the ordinary sore throat of scarlatina assumed a diphtheritic character. Among many examples of this complication that I heard of, I obtained satisfactory information only of six cases in which extensive faucial concretions, not distinguishable from those of diphtheria occurred in the course of genuine scarlatina. In the first of these, that of a boy, æt. 8, the onset of the disease was violent, and attended with convulsions; a characteristic eruption appeared on the third day, and three days after, the child having already suffered from sore throat, the diphtheritic concretion appeared. On the seventh day there was slight desquamation, which was followed by albuminuria and dropsy. In the second case, that of a child æt. 4, the eruption appeared on the third day, and was followed about the seventh by desquamation, at the same time with which the diphtheritic pellicle began to form; it soon became extensive and was followed by ulceration of the velum. Death at 14th day preceded by convulsions and apparent insensibility. In the third, (a boy, æt. 5), the eruption also appeared on the third day, and the diphtheritic pellicle was then first seen, but did not become extensive till the fifth. Desquamation commenced on the eighth day, and was followed by albuminuria and dropsy; recovery. The fourth occurred at Littlebourn. A girl, æt. 12, was first seen on the 10th of April 1859, and had then an abundant eruption of scarlatina. On the 13th the concretion of diphtheria appeared and extended rapidly. This occurred during the prevalence of diphtheria in the village. Soon after the child became dropsical and the urine was found to be albuminous. The fifth case was that of a girl, aged six, residing at Barfreston, one of a family of four children, all of whom were at the time suffering from scarlatina. She was first seen in the eruptive stage two days after, the eruption being still distinct, the throat altered its character and became covered with diphtheritic concretion. Com-

plete desquamation followed, and eventually the child became dropsical. There were no cases of diphtheria at the time in the village. In the sixth case, the eruption appeared on the third day, the concretion on the day following: there was no distinct desquamation, no dropsy, nor albuminuria.

I met with a few cases in which diphtheria occurred consequently upon measles. In five instances children died rapidly with faucial concretions and the symptoms of croupal suffocation, after apparent convalescence from measles. It appeared as if the exudation had commenced in the larynx, or even in the bronchial tubes, rather as a complication of the consecutive catarrh, than of the acute disease.

Hæmorrhagic Conditions of the Skin.

Hæmorrhagic conditions of the skin were met with occasionally; the cases were invariably fatal in short periods. Of three of these cases, of which I have notes, the following were the prominent features:—In the first there was no febrile action whatever; a macular eruption, resembling purpura, existed two or three days before death, during which period there were general coldness and pallor of the surface, anxiety of the countenance, extensive bleeding ulceration of one tonsil, with livid congestion of the surrounding mucous membrane. In the second case, that of a youth æt. 17, the diphtheritic concretion appeared on the third day, the urine containing albumen. On the fifth day purplish, hæmorrhagic blotches, were first observed, which spread over the trunk and lower limbs. Death on the eighth day, preceded by paroxysms of suffocation. The third case, a child æt. 7, was similar to the first, excepting that ulceration was not noted. Faucial exudation was extensive; and during the last three days there was extreme prostration, and coldness of surface.

Cutaneous Diphtheritic Concretions.

The following were the only instances I met with:—W. G., æt. 8, became ill June 7th, on which day a bulla of rupia simplex appeared on his right index knuckle, and another on the forehead, at the root of the nose. On the third day after their appearance, it was found that the surface of the corium, beneath the now flaccid and ruptured epidermis, was covered by a firm white pellicle. Each eye was surrounded by a zone of erysipelas, with vesication here and there on the red and swollen surface. There was intense swelling and redness of the velum, uvula, and right tonsil, and the last was covered with diphtheritic concretion. The skin was cool and pallid; there was extreme muscular weakness and prostration. Pulse 84. He died the following day.

At Ash, in a family consisting of an infant, æt. nine months, and two older children, the latter contracted faucial diphtheria, which assumed its ordinary characters. During their illness the

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infant was suffering from extensive excoriation of the skin of the chest, produced by the constant dribbling of an acrid discharge from the mouth. When first seen the whole of the inflamed surface was covered by a membranous concretion of firm consistence. The infant died in the course of the following day. No affection of the fauces could be discovered.

A little girl, æt. 11, one of a family in which two fatal cases of faucial diphtheria had recently occurred, was on March 4th under treatment for a scald of the foot. On that day she contracted the disease. About a week after the concretion had appeared on the fauces, the scalded surface became covered with a pellicle, which soon acquired sufficient thickness and firmness to be detached in flakes. This separated spontaneously, leaving a healthy sore. There was no sloughing at any time, and the patient did well. In another example a similar concretion was formed on the reddened and partly blistered surface produced by the application to the skin of the *Linimentum Ammoniæ*.

VII. Treatment.

a. *Escharotics.*

The lunar caustic in substance had been largely employed at Launceston and in Kent. It was the general result of experience that it was of considerable utility in those cases of rapid extension or reproduction of the concretion in which it was possible to apply it to the mucous surface itself, in such a manner as to limit the exudation or prevent its renewal. At Rothwell and Hanley the use of escharotics, whether in substance or solution, had been entirely abandoned; and, indeed, in all the districts the observation of their effects had tended to diminish the confidence of practitioners in their general utility. In Kent the nitric and hydrochloric acids had also been extensively used.

b. *Stimulants.*

At Ash, at the beginning of the epidemic, it frequently happened that children, apparently well in the afternoon, were dead before next morning, death being preceded by no other symptoms than those of profound prostration already described. Although in many of these instances of what might be truly called malignant sore throat, no treatment appeared to exercise any influence in averting the result, it was not the less certain that whenever in a case of this nature the fatal progress of the disease *was* arrested, the success was always obtained by persevering in the unlimited exhibition of wine and quina, and in the frequent administration of nourishing food. On the other hand, experience has led to the discontinuance of the indiscriminate use of stimulants in every case, it being found that a large proportion of patients do well under any, excepting a decidedly depressing treatment, such as e. g. emetics or purgatives.

Tracheotomy.

Tracheotomy was performed in one instance only. The result was in so far satisfactory that life appeared to be prolonged for several days.

Tonics.

The tonics which were found most useful against the sequelæ of diphtheria were iron and quinine. In several cases at Launceston removal to the sea side was followed by rapid recovery.

The *Mistura Chlorinei* was in extensive use in all the districts, and was much confided in by practitioners.

The mineral acids alone appear also to have been used with advantage, and Mr. Collier, of Minster, related to me cases in which he attributed much of his success to the administration of creosote.

Specifics.

No particular drug was found to exert a specific influence against diphtheria.

Diphtheria in some Inland Districts of East Sussex and Neighbouring Parts of Kent. (J. S.)

Information obtained from Mr. Gravely of Newick.

MR. GRAVELY.

1. *District?—Mr. G.* has charge of three parishes,—Newick, Chailey, and Barcombe; aggregate population at last census, 3,304. The district is not of uniform level. Newick and Chailey North Common lie about 100 feet above the river, which is a mile distant; other parts lower. Except commons, is well drained, and highly cultivated. Chailey North Common has some boggy patches; and for Chailey see below. Population much scattered, The district has superficial wells, varying a good deal in quality, Mr. G. believes none to be foul; but last year there was extreme drought. Some of the poor drink from ponds.

It is doubtful if ague ever arises here; occasional groups of typhoid fever, but not every year. A good deal of autumnal diarrhœa. At times rather a large proportion of erysipelas. On several occasions has had, at one time, two or three cases near one another.

2. *Course of Epidemic?*—The first case of diphtheria was in October 1856; since when Mr. G. has had, he thinks, fully 200 attacks under his own care. During the last ten months there have been 43 deaths; all but eight or ten in Mr. G.'s practice.

3. *Concurrent Diseases?*—He had a great deal of sore throat at the same time with diphtheria. In a very few of these cases

(perhaps three or four) there was ulceration, not severe, of the tonsils; in other cases simple superficial inflammation.

Scarlatina did decidedly not prevail in the district. There was a single case where a puerperal woman died (October 22, 1858) with scarlatinal rash and slight sore throat. It was believed that about a fortnight before she had communicated with a source of scarlet fever infection.

During the diphtheria epidemic there was scarcely any other illness.

There was no illness of domestic animals, except that eight or nine cows, in one farm-yard at Chailey, had a peculiar affection of the conjunctiva, with diffused cloudiness of cornea; and the appearance of the eye was as if something parasitic were in or under an oblong oval patch of the conjunctiva.

4. *Predisposing Circumstances?*—Many of the worst cases of diphtheria have occurred in very cleanly and well-ventilated houses. In some of the very worst houses in Chaileg there was no case. [In one group of four four-room tenements, with 20 or somewhat more inmates, there were eight severe cases and six deaths; four of these in one family. These houses were at the lowest level in the parish, built on clay, with swampy ground in front of them, and rushes growing all about. They had one cesspooled privy a little distance behind them. Further off was a well; water described as hard and "salty." Some preferred getting water from a pond. Plenty of windows and backdoors. No particular disease in these tenements. Seven or eight years ago there was in them one mild case of typhoid fever.—J. S.]

Mr. G.'s constant observation, especially at the commencement of the epidemic, was that it occurred oftener and more severely in well-constructed and well-kept houses. Cases did not occur among the first-class inhabitants of the district; none in the workhouse; hardly any among the very poorest inhabitants; the great majority among the better off labouring classes and small tradespeople. Mr. G.'s own child was an almost solitary case in his station of life.

Patients have died since August 1858, in Mr. G.'s district as follows:—

Newick (on sand) - - - -	8
Chailey (on clay and sand) - - -	32
(The richest and best looked-after population.)	
Barcombe (chiefly clay) - - - -	3
(The poorest and worst looked-after population.)	

Children, aged 2–10, have been the chief sufferers. In the present epidemic, only one case over 40 (not fatal) and only two deaths over 20 years of age. Many, aged more than 20, had it. The weak have not seemed more liable than strong.

Mr. G. knows many cases where diphtheria has been suffered by those who at former periods have had scarlatina. He refers to one case of a girl, deaf and dumb from scarlatina in infancy, who recently has had severe diphtheria.

5. *Communicability?*—There were cases where several children remained exempt, notwithstanding free communication with the sick in houses where diphtheria was present, *e.g.*, in the house where the first of the recent cases occurred. Also a single fatal case occurred in a house (beyond the workhouse) with large family of freely mixing children. But, generally, where one case had arisen in a house, if there was communication, all, or nearly all, the children of the household were eventually attacked with diphtheria or other kind of sore throat. Sometimes two or three attacks have been simultaneous; often they have followed closely on one another, only a day or two intervening; sometimes there have been long intervals.

In the autumn of 1856 a waggon load of Newick people (perhaps a dozen) returned from hop picking at Rotherfield, where they had been at work, it was said, with persons who recently had suffered scarlet fever or quinsy. [See Mr. Moyce's evidence below.] About two days after this return Mr. G. was sent for to an old woman of the party; she died next day, October 7, and her illness was recorded as "inflamed sore throat." Her house had no other inmates than her husband, and he did not contract diphtheria. Within a day or two Mr. G. was fetched to a girl, aged 6, also of the party, but living in another house. This girl was apparently but slightly ill, yet she looked pale and depressed, and had some external swelling, which suggested a suspicion of mumps; she died next morning. On then opening the mouth, exudation was seen on both tonsils. The house was new, very ill-ventilated, and dirty. Rapidly after this case there ensued in the same house nine other cases, of which seven died. They were all of children under 12 years of age, except one at 21, who recovered. All these were cases of diphtheria, and all had been hopping. The house had no other inmates except the parents, who complained of slight sore throat, but had no formidable symptom. The child who recovered of this party was attending an infant school half a mile off. The school was closed for three months. On its re-opening the child went again. Within a week, the mistress's own infant had diphtheria and died, and one or two of her other children had slighter attacks of diphtheria. There were some other cases, but particulars are now lost.

From that time Mr. G. attended no diphtheria till August 1st, 1858. Cases were spoken of in surrounding districts, but there were none in his parishes. August 1st, he was called to a girl, aged 6, with slight diphtheria, which soon yielded; soon (within ten days—the girl being out of doors) she sickened with measles, which was already in the house, had a sharp attack, and on convalescence got diphtheria again, from which she died, August 15. Her brother, aged 5, died of diphtheria a week afterwards. These cases were in Chailey North Common, "said to be the healthiest spot in Sussex." No contagion was suspected, but the children probably attended a school of 200 children. A young woman aged 21 nursed these children (coming for the purpose from five

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miles distance) caught the disease, was sent home, and died, August 20. No case occurred in the house to which she went; there were other inmates; she was nursed by her mother and elder sister. The house was very spacious, and ventilated, and chlorides were greatly used. In the original house there were several other children who escaped, not being separated from the sick. Diphtheria then spread in Chailey and Newick. Mr. G. had at times probably 12 to 15 cases at one time under treatment. Since the end of December it has been diminishing. The last patient he lost died last week, and he has now only two convalescents.

Nearly all who died did so with windpipe complication; perhaps six to eight by sequelæ. Apparent healthiness certainly gave no exemption

6. *Symptoms?*—The usual duration of short cases in this epidemic has been five or six days. Premonitory symptoms were curiously well marked:—Extreme drowsiness; "children would lie and sleep half the day;" no head-ache, but "aching all over;" thus perhaps for a day or two, and believed to be suffering from an "influenza cold;" then often (but by no means always) pricking of throat; or increasing languor and depression would very often lead to examination (no complaint having been made) when the throat would show swollen and dark red, and within a very few hours there would be exudation. "As a rule, the throat is the last part complained of." In some cases bilious vomiting has been an early symptom, and might have been taken for a simple bilious attack.

Mr. G. has not seen any cases of sudden, unexpected death; sinking has been gradual. Sometimes for a few hours before death there would be apparently more disposition and power to swallow than for several previous days. Stimulants now had no effect.

Mr. G. has not seen any secondary ulceration or sloughing. In one case a part of the uvula seemed to come away with the diphtheric membrane, and sometimes the tonsils appeared to have ulcerated depressions in them when the membrane separated.

Sometimes (not often within sight, but probably oftener in the trachea, the once relieved respiration getting bad again) successive new layers of fibrinous matter have coagulated on the excoriated surface. In some cases there was very offensive, sanious, irritative discharge. Where there is much nasal discharge the case proves generally fatal.

In the epidemic of 1856 almost always the diphtheria extended over the hard palate to the front teeth.

In a great many cases, and Mr. G. believes, all fatal, there has been expectoration of tracheal casts. Most cases that were fatal were so in this way; not only children, but also adults. In two fatal cases (patients aged 21) there was expectoration of *very* small bronchial casts.

Almost always the lymphatic glands below the jaw were swollen. In one case there was a large abscess, and in some other

cases smaller ones. The cellular membrane of the neck was found often irritated and swollen, but not going on to suppuration. In the epidemic of 1856 there was absolutely no febrile excitement. At other times it was of very short duration.

Mr. G. does not recollect ever to have seen delirium. Great sharpness of hearing in many cases.

The nervous sequelæ have come on after an interval, perhaps three to four weeks after the throat has got well, and five or six weeks from the beginning of the attack. Patients who have been about, have been obliged to lay up again with a weakness, which has gone on increasing for two or three weeks; none have died. The severity of these nervous sequelæ is not proportionate to the severity of the primary disease. In some cases peculiar voice; regurgitation of food, solid and fluid; often pins and needles in both extremities, not long continued; more or less failure of the lower limbs in most of the cases of recovery from diphtheria, sometimes to the extent of perfect inability to stand or walk; not accompanied by anæsthesia. No weakness of arms noticed. Singular paralysis of neck muscles occurred in Mr. G.'s own little boy, aged 2; the head used to roll by its own weight backwards, forwards, and sidewards, till Mr. G. feared dislocation might arise; and when the head had settled the child was apparently unable to move it, and looked about him with a curiously slow turning of the eyeball.

There was impairment of vision in many cases, but not in so many as had muscular weakness. The patients saw indistinctly and doubly. A girl of 15 years sees well to do needlework in her grandmother's spectacles, without which she could do nothing of the kind.

A few small spots (like fading fleabites) have been noticed on arms and chest in a few cases; the issue of such cases not now remembered. No cases in which the skin has desquamated. No cases in which the throat affection has been accompanied or followed by serious inflammation of internal organs, or by any kind of hæmorrhage.

In one case dropsy has ensued. A boy 7 years old was convalescent; had been running about, and was considered well; got œdematous eyelids, then œdematous legs, and died within a very few days. The urine boiled in a spoon did not at this time precipitate. One patient had whitlows on all the fingers and thumbs. One patient (not Mr. G.'s) had extension of diphtheria up the nasal duct to the conjunctiva, and lost his eye.

Relapse has occurred in two cases. One (measles intervening) already referred to. In the other, a boy, æt. 13, convalescent from severe diphtheria, went to school; a few days afterwards got wet through; in the evening had a rigor; next day (again seen by Mr. G.) had exudation in throat; in a few days died of tracheal extension of disease.

Besides what has already been mentioned, a broad margin of dark reddened mucous membrane beyond the limit of the exuda-

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tion has promised an extension of the diphtheria, and probably a fatal result. A well-defined exudation without surrounding redness is less alarming.

7. *Treatment?*—Mr. G. has discontinued escharotics, and thinks the less the throat is disturbed the better. He has seen a part diphtheric one day, which he had cauterised the day before.

He has given zinc sulph. i, for emetic; or if there has been fever has added ipecac. gr. x.; afterwards tinct. ferri. sesquichl.; externally fomentations and poultices. In many cases external vesication with strong iodine paint; which he thinks has done good.

In cases where iron seems to cause rather obstinate vomiting, ammon. sesquicarb. in its place for a time does good; subsequently the iron may be resumed.

MR. MOYCE.

Information obtained from Mr. Moyce of Rotherfield.

1. *District?*—Contains population of about 3,500. Mr. M. has practised there about 18 years. The district has been "notorious for healthiness;" very little clay, chiefly sandstone; probably damp; extensively wooded. Water reckoned very good, but was low in 1858. Ague little known. Occasional fever, and a good deal of autumnal diarrhœa. A great deal of bronchocele, which runs much in families, chiefly among women.

2. *Course of epidemic?*—For three years diphtheria has never been entirely absent for two months at a time; has remitted most in the summer months of the three years.

There have been about 300 attacks of true diphtheria, and Mr. M. has been attending more than 30 at a time. In the winter of 1856–57 it prevailed not only in the village, but generally in the district, including the most inaccessible parts. In the winter 1857–58 nowhere so severe as at first, and mildest in the village. In the winter 1858–59 general. Since then till June only a few scattered cases.

3. *Concurrent diseases?*—An immense deal of common inflammatory blush of tonsils, not going on to ulceration or sloughing.

Mr. M. believes that for the last four years he has had not one case of scarlatina, till a single case four weeks ago, in a child who had diphtheria in 1857.

4. *Predisposing circumstances?*—Mr. M. has seen diphtheria in first rate farmhouses, in excellent condition as regards cleanliness and ventilation. It seems to have spread pretty equally among well off and poor, among clean and dirty, at high level and low level. It was very severe at Crowbury, which is the highest point of Sussex, on sandstone, with excellent water. Many of the houses are ill constructed, but it prevailed also in the good as well as bad houses.

5. *Communicability?*—May 12, 1859, the parish being at the time entirely free from diphtheria,— Sarah D., aged 15, servant at Tunbridge Wells, was sent home with severe diphtheria to her parents' house at Woodside, where there were five other children. Within a few days the next girl, aged 10, showed signs of throat disease, which apparently yielded to treatment; but June 9th she was seen with confirmed severe diphtheria, great exterior swelling, immense blocking up of isthmus faucium, patchy, purplish congestion of cheeks, and died the same night. [Both these patients had been attended for diphtheria by Mr. M. two years ago.] Three others of the family had inflamed throats without exudation. One of the little ones had a very small but distinct patch of exudation on tonsil. The fifth, aged three, got croupy symptoms, with no visible inflammation or exudation in the throat, and died in about 60 hours, suffocated. This family was living in a large but sub-divided house, with quantities of most offensive filth ponded round about it.

Mr. M.'s first case, that of Mr. R., aged 20, was in Oct. 1856. Mr. R. had been superintending a hop garden, about a mile from his residence. While the work was going on (it lasted a month) some of the people began to complain of a sore throat. It was not known that any had come from a diphtheric neighbourhood. Just after the close of the picking, Mr. R. complained of sore throat, and in about eight days (Oct. 24) was dead of diphtheria. The next case was that of his mother, who lived with and nursed him during his illness. She had diphtheria of pudenda, but no affectior of throat. Her treatment began Nov. 1st. She had serious and long-lasting sequelæ, great prostration, and perfect helplessness of legs; no affection of vision; no affection of voice. The pudendal affection was chiefly of one labium, with great swelling; there was no bubo. Mr. R.'s servant, who, as well as his mother, attended him, likewise had diphtheria soon after the mother's attack. There were two other adults in the house who did not suffer. November 8th, Mr. Moyce himself was attacked. On Oct. 23 Mr. R., whom he was attending, had spluttered a quantity of offensive matter into his face. Mr. M.'s is given below.

Diphtheria occurred also singly in households, where there were children in free communication with the patient.

6. *Symptoms?*—The diphtheric membrane was thrown off in four or five days.

Sanious discharge from the nose was frequent, but not universal, in severe cases; is of very bad augury.

"Dozens" have had bleeding from the nose. At Crowbury three in a family, and all died. The usual period is about seventh and tenth day, when the throat is clear, but the sanious coryza continues. It is usually in smallish quantities, frequently repeated, and contributes materially to kill. Mr. M. thinks it one of the worst symptoms.

Sudden deaths occur during recovery from the throat affections. Patient will be up, cheerful, but very pale, and with very small

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pulse, walking about the room, and in an hour or two will be dead. One died in five minutes after getting up in night to close stool, being then supposed almost well. A boy aged 11 or 12 died of exhaustion during paralytic stage, two months after he was quite clear of throat disease, in a state of complete muscular helplessness of trunk and limbs; movements of heart and respiration having apparently gone on well. Children have generally suffered less. Sickness has not been a troublesome symptom in any case. The large majority of Mr. M.'s cases have been treated not in bed, but sitting in chimney corners, &c. Mr. M. has seen no eruption of any kind. In two cases he has seen liquid hæmorrhage mixed with diarrhœal stools, when the throat was beginning to improve. One of these recovered; the other died of secondary debility. One female patient (see above) had diphtheria of vagina.

Mr. M.'s personal experience of the disease was as follows:—Nov. 8th (having for about three weeks been in attendance on the first cases of diphtheria) he felt a pricking sensation, which soon became burning, at the right tonsil, and in the night had a great deal of pain, with a sense of swelling. Next morning the tonsil showed exudation of the size of a farthing, and this afterwards gradually advanced forwards almost to the teeth. There was very little on the left side. Great exterior swelling. After four or five days the throat began to clear; then came on a difficulty of deglutition—an intense cutting pain which amounted to "agony." During this he never kept his bed. After three or four weeks he was able to get about, and for a fortnight attended to his practice. During the latter half of December he began to get alteration of voice, and to have regurgitation of solid food, which, when he thought it swallowed, would accumulate in the posterior nares, till it produced spasmodic cough. Fluids, if very slowly taken (20 minutes to a glass of wine) went straight. Then he became unable to use his tongue; could not move it in eating; speech became unintelligible; next came paralysis of the glottis, such that he could not strain, and that on this account he had to take purgative medicines. Then peculiarity of eyesight; saw double; no strabismus, but with one eye he saw indistinctly; could see with spectacles. Then tingling and tenderness of the palmar surface of the fingers and hands, where, by his wife's description, the integument became peculiarly hard and rough—shagreeny; then a similar affection of soles and toes; then loss of power in limbs, especially in legs, which were utterly without power, folding under him "like a wet rag." Arms so weak that he could not feed himself; sphincters were not affected. These symptoms continued without abatement for eight or nine weeks, and then gradually diminished in the order in which they began. Even now, $2\frac{1}{2}$ years having elapsed, is not strong. Cannot either walk or swallow as he could. Six children were in the house and occasionally in the room; his wife nursing him, and sleeping in the same bed. None took it, nor any servant. But one year afterwards two of the children had slight attacks.

7. *Treatment?*—Chlorine wash, mineral acids with bark, as soon as fever has passed, and nourishing diet, with wine, are Mr. M.'s chief measures of treatment. DIPHTHERIA. MR. MOYCE.

Information obtained from Mr. Jones, of Fletching. MR. JONES.

1. *District?*—It includes Fletching and Maresfield; population 4,000; area 16,000 acres. Mr. J. has practised there 27 years.

The water supply is generally abundant, and tolerably good. The meanest cottages have wells to themselves.

There was no ague, till the end of 1855 or the beginning of 1856, when an outbreak took place on Piltdown Common, affecting (particularly on the east side) nearly every house, and in some cases all the inmates. Was soon followed by cases in other parts of the district. Since then Mr. J. has always had some cases of ague in hand, in some part or other of his district; mostly on highr grounds.

Habitually there was very little fever; but for the last year there has been a good deal in the district of Chelwood (north side of district) a poor neighbourhood on border of forest. Latterly diphtheria has been very prevalent there, and the two diseases have in some cases been present together in a house. Not much diarrhœa; never cholera; a good deal of bronchocele. Till 1855, Mr. J. considered his district very healthy.

Course of epidemic?—Diphtheria appeared first in July 1857. From then till now it has never ceased, except for a month or two in spring 1858, but this not dependent on spring; for this spring again there is a great deal.

The number of attacks of diphtheria was at least 250, and 21 deaths occasioned by it.

There is no local recollection of diphtheria having prevailed before in the district or neighbourhood.

3. *Concurrent diseases?*—Simple sore throat, not often (if ever) with ulceration, has been very extensively prevalent with diphtheria.

Scarlatina did not prevail in the district about the same time as diphtheria. Its last great prevalence was 4 years ago, when almost every case had anasarca and albuminuria afterwards.

Mr. J. has had two cases on Piltdown Common of puerperal albuminuria with anasarca, one with convulsions, one threatened.

4. *Predisposing circumstances?*—Seasons and localities seemed to make no difference to diphtheria. It has occurred even more among the better class of poor than among the destitute, unprovided, ill-conducted. Mr. J. has not associated it with sanitary defects in houses. It has run through thoroughly cleanly and not overcrowded houses. The great mass of cases has been at the ages of 4 to 15; till quite lately, none over 40 or under 2.

On Sheffield Green (a bit of rather high-lying and open common land, traversed by the highroad, with birches, Scotch firs, and oaks scattered about it, and in parts a good many rushes) nearly

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every house of about twelve, built round the common, had diphtheria; probably 30 cases in all; and in every case there was eruption. On Dane Hill, the highest and driest spot in the neighbourhood, the butcher's son died of diphtheria, aged 17, and some weeks after his brother had an attack; but there were many children in the house who all escaped. On Beacon Hill, nearly the highest ground in Sussex, there were in one house 6 cases. On Chelwood Common, at nearly the same level, with very irregular dell-ground running up to it, there were cases; soil apparently dry and sandy, growing ferns and firs. Piltdown Common, where also there were cases, is for the most part sandy, but with some clay; seems dry, and is relatively very high. The first cases were at a boys' day and boarding school on the Uckfield side of the common.

Scarlet fever makes no difference; children who had scarlet fever in the last epidemic have had diphtheria now.

5. *Communicability?*—Mr. J. thinks diphtheria very slightly communicable.

As a general rule, it went through the house, if there were children, including often the parents if under 40.

A second case has sometimes been a fortnight after a first. Usually they have been simultaneous.

On Piltdown Common, one girl in a large family escaped last year, and this year has had the disease; and there were other instances of the same sort.

In many localities the disease has come on where there has been no suspicious communication; in remote farmhouses.

6. *Symptoms?*—At about the 5th or 6th day the diphtheric membrane is thrown off.

Mr. J. has only seen in one case sloughing of the mucous membrane occurring at the later stage of diphtheria. In this case there was afterwards paralysis and blindness. Where the diphtheric membrane has been artificially removed, Mr. J. has seen new layers of fibrinous matter coagulate.

He does not remember to have had epistaxis, and never suppuration.

Mr. J. has noticed complaint of general pains as premonitory, but has not noticed drowsiness. There has been chilliness. The febrile excitement was never high, nor long continued. What little there is passes off in 36 hours. Shortest febrility in worst cases. No delirium; the mental faculties clear to the last.

Signs of depression are especially developed by erect posture, or muscular exertion, even during convalescence. Prostration (resisting all treatment) has set in after exertion, in persons apparently having but slight remaining debility, and accounted well. Such prostration would be fatal in 12 to 24 hours. Nothing stops it.

Scores of cases (probably at least 50 or 60) have had more or less eruption. In one case it was general and bright (came out, Mr. J. thinks, on the second or third day of illness, and began on the chest) continued for a week or more, and the skin afterwards desquamated. It was like scarlatina (which the patient was

believed not to have had at any previous time) but the whole surface was covered with minute miliary vesicles of clear fluid, "one mass of small vesications;" a great deal of itching; no subsequent dropsy; the patient recovered. In other cases the eruption was partial; principally over exterior side of arms and forearms, and on back and chest, in irregular patches of several square inches extent; in others just a few spots. It had not the bright colour of scarlet fever (except in the one case above) but a sort of dirty-red brick-dust colour. Always with it there was marked itching, so that children's arms and backs would have lines of scratching on them. No considerable heat precedes or accompanies this eruption; quite different in this respect from the purgency of scarlatina. But in at least some of these cases (and not in the non-eruptive cases) the tongue has been red, with prominent papillæ, and there have been cases of eruption where no continuous throat exudation has been visible, but only spots on the tonsils. The cases with eruption have been usually milder cases, as regards throat symptoms.

General desquamation has commonly occurred in cases where there has been eruption.

Anasarca occurred in probably 10 to 12 cases; it was fatal in one, a child aged 4, who previously, perhaps two years ago, had, according to the mother's statement, had scarlatina.

In one case inflammation extended up the nasal duct to the conjunctiva, with immense chemosis, so that the lids could not be closed; the membrane was scarified; hæmorrhage continued for 2 or 3 days, when the patient died from it. The urine has been found albuminous, whenever examined, which commonly has been in the cases of anasarca.

In one case (the throat having recovered) patient died after 48 hours suppression of urine; kidneys gorged.

Mr. J. thinks sickness as a late symptom is one to justify unfavourable prognosis.

The first of the secondary symptoms is nasal twang, like a patient with syphilitic destruction of the palate. Comes on some days after the patient has been up and moving about. Then dimness of sight, going on in some cases to a great degree of blindness, with dilated, but not very dilated pupil. Then blunted touch in the fingers, which feel as though with a glove on the hand. With convalescence came the feeling of "pins and needles." Then failure of power in the legs, which become "like a rag." No affection of bladder. These symptoms would reach their maximum in about 14 days from their commencement, and would continue, before total recovery, for 3 or 4 months. Heart's action somewhat feeble, but never irregular. For some weeks there may be nasal regurgitation.

7. *Treatment?*—Mr. J. uses now, both externally and internally, a saturated solution of iodine in rectified spirit, applying it once a day, with a mop of lint, and recommends attention to local cleanliness. Has adopted the rule of making his patients during the primary stage of diphtheria gargle out the throat and mouth, before

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taking food, or drink, or medicine, and thinks that since doing so has been more successful. Thinks well of chlorate of potash, in mixture with citrate of iron—pt. æq. Where a case was seen early, he invariably commenced with emetic of ipecacuanha, followed by calomel, with jalap or rhubarb; after which he regulated the bowels with castor oil. For sequelæ he gave quinine and iron, with liberal diet. Insists that the least exertion is to be avoided.

MR. HENRY HOLMAN.

Information obtained from Mr. Henry Holman of East Hothly.

1. *District?*—Mr. H. has practised here for 40 years. Frantfield, Chiddingly, and Hellingly (which have been the chief sites of throat disease) are all on clay. Waldron (where recently there has been a good deal of typhoid fever, but no diphtheria) is on sand. The water supply has been scanty for two years. During the last 30 years improvements of drainage have been made, and ague has greatly diminished in districts between here and Newhaven. For the last year or two ague has been again much more prevalent. For the last two or three years, continued fever of various types (including an unusual proportion of typhoid) but with hardly any deaths, has been prevalent here; and in a large proportion of them certainly three-fourths, there has been complaint of sore throat.

Course of epidemic?—Two isolated cases of diphtheria occurred; the one in October 1857, the other about Christmas 1857. Except those two, the first case was in July 1858, the great stress of cases has been since Christmas, first in Frantfield, then in Chiddingly, then in Hellingly. Little true diptheria in East Hothly, but a good deal of sloughing tonsils.

The number of attacks of true diphtheria was 50, and of deaths 20. There is no local recollection of diphtheria having prevailed before in the district or neighbourhood.

3. *Concurrent diseases?*—A great deal of other sore-throat has been prevailing for the last year and a half; reddened fauces and tonsils, with spots of abrasion on palate and tonsils. One touch of caustic has cured them. In other cases there has been considerable destruction of tonsils; very distinct slough, which could be taken hold of, and pulled or pushed away, when it was loose, leaving a distinct considerable hole. Sometimes, though not often, the hole would be made by ulceration. These affections were always at the tonsil. Sometimes both tonsils were involved, and sometimes with them the uvula. In these cases there has been fever,—tongue swollen and coated, not papillated; fever of short duration—24 to 36 hours; no delirium; tendency to depression.

There were about 250 cases of sore-throat, of which at least 50 had sloughing tonsils. In two cases recently Mr. H. has had what he considered simple croup in infants, and on the child's death subsequently certified as such; but within a few days cases of true diphtheria have followed in other children of the house. They have

habitually a good deal of croup in the district. Not more on clay than on sand.

In Frantfield scarlatina was prevailing, though only in two houses, at about the same time as diphtheria, so that the two diseases could be seen side by side. The scarlatina was in its usual form; as to throat, as to febrility, as to skin. Otherwise scarlatina has been absent; enough so, for two years, for the fact to have been commented on.

No other disease, either of the human subject or of the lower animals, prevailed in the district to an unusual extent, or with unusual features, either during or shortly before or shortly after the prevalence of diphtheria.

4. *Predisposing circumstances?*—The chief ague parish here is Laughton, and Mr. H. has not had a single case of throat disease there. At the present time there is much ague there.

Cases of true diphtheria have occurred among very well-to-do people, in reputedly healthy situations, and in houses which (except perhaps as to soil) were unexceptionable houses; and very bad sloughing throat has occurred in the principal houses. Under such circumstances the disease is more manageable, and less apt to spread. Very few deaths among the better-off classes. At Frantfield eight diphtheria cases occurred, and 4 died, in a well-ventilated roomy good-class farmhouse, on clay, but not low. At East Hothly rectory the whole household had sloughing throat, but no diphtheria: they are on clay; and there is standing water.

As regards relation to scarlatina, three sisters, G., aged 7-14, who three years ago had been attended by Mr. H. in severe scarlatina, and who were now residing in a pretty decent labourer's cottage, were attacked as follows:—Ruth had sloughing tonsils, followed (see below) by anasarca; Hannah at the same time had sloughing tonsils, and appeared to be recovering, but about three weeks after had a fresh attack, and died within three days, having in this second attack had much tonsillary and submaxillary swelling, with croupy respiration and purplish face, but no visible false membrane; Sarah was ill with diphtheria while the others had sloughing tonsils, and made an easy recovery. There was no scarlatina in their neighbourhood.

5. *Communicability?*—Mr. Holman's assistant, aged 25, contracted diphtheria while visiting cases at Buxted, and died at Mr. H's house, the disease then not being prevalent in East Hothly. Mr. H's. son, aged 25, two servants aged under 20, were in attendance on him, besides elder persons, and there were several children in the house; but no second case occurred there. Another isolated case occurred October, 1857:—a young man came from Buxted with diphtheria to a house where his young sisters attended him, and where children were under the same roof; house roomy and decent.

About Christmas 1857, a man residing at Waldron visited a diphtheric daughter aged 13 in service at Ringmer, and caught sore throat: he brought his daughter home, who soon after died: diphtheria then broke out in the family, affecting the three other

DIPHTHERIA. MR. HENRY HOLMAN. children, two of whom died: the mother got sore throat: this was in a cottage, with but one bedroom: diphtheria was not previously nor has it since been at Waldron, which is in a high and dry and healthy situation, on sand: no eruption in these cases.

Of the family with which the above girl resided at Ringmer, there were some members resident at Waldron, and one of these, a girl aged seven, had been staying at Ringmer during the epidemic. She came home to Waldron with slight diphtheria, and recovered. A sister, aged 13, who slept with her during her illness, took more severe diphtheria in about a week, and also recovered. Then the mother, at 30, took it, had a good deal of false membrane, but recovered. House was large and airy. The mother's attack began about ten days after the sister's. None had eruption.

In Frantfield, where diphtheria has been prevalent for three months, and very malignant, it has prevailed over a mile-square patch of country; scattered houses, with no discoverable communication between the families. In one case a man, Berry, aged 45, had typhoid fever lasting a month. Before his recovery his eight children fell ill with diphtheria, and four out of the eight died. He had no sore throat. The mother had diphtheria, and recovered.

Of another family, also in Frantfield, one child, aged six, died with diphtheria, in the severest form, three hours after having been first seen. A few days afterwards a second child, aged five, was taken with diphtheria, and recovered. In the course of a fortnight four other children were attacked with feverishness, which Mr. H. thought was the beginning of diphtheria; but dysenteric purging, with bloody mucus, came on, and lasted several days, in the worst a week. A man at 70 suffered in the same way. No diphtheria occurred.

6. *Symptoms?*—Sequelæ do not seem to have struck Mr. H. very much in connexion with proper diphtheria. He says the cases of this disease get well (if at all) better than those of sloughing throat; that secondary symptoms have been in the latter class of case.

W., a girl aged 15, had sloughing tonsils; no eruption or anasarca; no false membrane; no discharge from the nose. Soon recovered, but remained feeble, and afterwards for some weeks complained of impaired vision, so that she could not see to read. Mr. H. has not been struck by it in any other case. In no cases has the skin desquamated. Mr. H. has never seen anasarca after true diphtheria, but after sloughing tonsils. In the following cases anasarca came on about ten days after recovery, and lasted in D. 6 weeks, in F. 2 weeks, in G. 3 to 4 weeks. D., a girl, aged 13, was said by the parents to have had scarlatina in her childhood; had now sloughing tonsil; no eruption; no scarlet fever tongue. F., a girl, aged 10, had been attended five years ago by Mr. H. for scarlatina; had now sloughing tonsil; no eruption; no scarlet fever tongue. G., a girl, aged 14, had been attended three years ago by Mr. H. for scarlatina; had now slight ulceration; no eruption; no scarlet fever tongue. Her sister

at the same time died of diphtheria. None of these had impaired vision, but D. had great failure of power in legs.

Weakness of legs has been frequent, and has continued even for months. Has been quite as much after sloughing throat as after diphtheria, probably even more. Indeed convalescence in severe cases of sloughing throat has, generally speaking, been more tedious and difficult than in cases of diphtheria. A. G., a man, aged 22, had very extensive sloughing of both tonsils and uvula; no false membrane; no discharge from the nose; much pain in the ears; not much external swelling; no croupiness:—he suffered for two or three months with great impairment of power in the legs:—he came from Frantfield, where diphtheria and sloughing throat were both prevalent:—he had no eruption; no anasarca. D. (who had anasarca) had great weakness of legs, lasting even now, though the attack was three months ago; so that, though she can walk $1\frac{1}{2}$ miles, it is very slowly and with much difficulty: —she had a somewhat severe attack, and was greatly depressed from the first.

No marked premonitory symptoms. If seen before false membrane has appeared, the diphtheric throat could be distinguished from the other by more crimson colour, and generally more implication of uvula.

7. *Treatment?*—Mr. H. has given up escharotics; uses only detergents,—mop of chlorine wash.

Deaths occurred in several cases at a time when danger was supposed to be past. Patient had been up, throat apparently quite well; sickness (or nausea and loss of appetite) came on, followed by prostration and death in about three days from the commencement of sickness. One case rallied after forty-eight hours of obstinate sickness, with use of morphia and hydrocyanic acid.

In many cases they have died in an early stage; within three or four days, with extension to the windpipe. No croupy coughing, but venous colouration of face. They are sure to die if the face gets that "purple hue." Two or three have spit up macaroni from smaller tubes "like quills."

In a third group of cases death occurs intermediately (without any apparent convalescence) from exhaustion.

B., a girl, aged 16, had very severe diphtheria; was believed to have had scarlatina some years ago: after eight or ten days, when the throat was cleaning, but the nose still discharging fœtidly, spots appeared on the legs, and a few on the chest,—dark purple spots, thickly studded, so as to give a general purple look to the surface, where they were of tolerably uniform size, probably one-tenth to one-eighth of an inch in diameter, with very slight elevation of surface; they continued out a week, gradually paling: she improved, got up, walked out, was seized with nausea and prostration, and in thirty-six hours was dead. Cannot say whether the spots persisted under pressure, but their appearance was petechial. No complaint that they itched.

There were several instances (though slight in proportion to

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the total) where there was eruption in cases of "sloughing tonsil." That was very temporary, lasting only sixteen or twenty hours, coming out two or three days after sore throat. It was not general, but in patches here and there; never on the face, but chiefly on chest and extremities. No complaint of itching. Each patch was irregular in outline, and was a *cluster of spots* (which gave one more the idea of incipient measles than of anything else) the spots being in size like those above mentioned, but of much brighter colour. Very soon gone. In one or two cases they lasted longer; never more than two or three days. All cases of this eruption were cases of sloughing or ulcerated throat; not of true diphtheria. None of them had anasarca, and all did well. In the majority of these cases Mr. H. inquired into the question of previous scarlatina, and learnt that the patient had had it. In many cases he knew this of his own knowledge; in some cases that it had been within two years.

In one case of diphtheria, patient, aged $1\frac{1}{2}$ years, there was a good deal of pustular eruption under the jaw and about the neck and parotid region, but it had come out some days before the diphtheria began.

MR. GEORGE HOLMAN

Information obtained from Mr. George Holman of Uckfield.

1. *District?*—Includes Buxted, Uckfield, and part of Frantfield; population 3,000 to 4,000. The water supply is good (streams) in all parishes. In the last two years ague prevailed very much; before that hardly, if at all known, and probably only imported. Also of late years more contagious fever (typhoid) throughout the district, chiefly in autumn. A little bronchocele.

2. *Course of epidemic?*—The first case of diphtheria was in July 1857; the last one February 1859. Worst from July to Christmas 1857.

There were 300 cases of sore throat, of which more than a hundred (vaguely) were true diphtheria. The number of deaths occasioned by diphtheria was about 30.

There is no local recollection of diphtheria having prevailed before in the district or neighbourhood.

The first cases were three mentioned below in a very low situation near a slow ditch at Buxted. It was suggested that these might have arisen by communication with Rotherfield, since the two places have a school in common at Crowborough, and the boy of the family (who now says that he was the first case of sore throat in his house) was attending at that school. The mother also says the boy had been ailing for some time, and talking a good deal about the Rotherfield sore throat; that he was poorly before his sister; but both were having sore throats at about this time; both seemed to have colds during this week, and "talked like it." It appears that both were at home thus ailing for ten days before the girl's death, but the girl was sent to school

on Sunday and Monday, and was seen on Tuesday by Mr. H., with her throat stuffed with exudation, and having much submaxillary swelling. She died on Thursday. At the same time, but how much earlier cannot be said, the boy had some diphtheric patches. He almost lost his sight; "could not see a letter unless he put his father's glasses on."

The next cases were on the hill, quarter of a mile distant, on sand; and for about half a mile each way along the direction of the ditch (not close to it, but scattered at varying distances) nearly every house had it. For four or five months the disease was chiefly confined to this district, where the soil is all sand.

Next cases were at quite different points of Buxted, three or three and a half miles off; very dry situation, also sand. The next at Haslewood, lying intermediately. And then the cases became less grouped.

In a cottage of five children, aged $1\frac{1}{2}$ to 13 years, sleeping in one room, three had diphtheria (one dying) and two escaped, aged respectively $1\frac{1}{2}$ and about $3\frac{1}{2}$.

The worst cases were with the poor; very few deaths among well-off people.

Concurrent diseases?—"Feverish sore throat" prevailed with diphtheria in the same neighbourhood and same houses.

Mr. H. does not remember scarlatina prevailing at same time as diphtheria, except in one family mentioned below, and with two children, at the workhouse school. In the latter instance the remarkable contrast of scarlatina throat and diphtheria throat could be observed by going from one room to the other, for both sets were isolated.

4. *Predisposing circumstances?*—The first 50 cases of diphtheria were all among the very poor, who were crowded.

Buxted, which has had most diphtheria, has also been most subject to fever; not much to diarrhœa.

It made no difference in the attack of diphtheria, if persons had previously had scarlatina or not. In November 1857 a family had scarlatina in the ordinary way; father and three children, with every common symptom, including rash. One of the little girls was under treatment for three weeks (Nov. 4 to 25) and had then returned to school, whence, however, the minister sent her away again. She had been running loose for more than a month, when she contracted diphtheria, and died after two or three days' illness, January 2.

5. *Communicability?*—Gentleman, aged 27, had been ill altogether 10 days, when he died. On the 3d November, the day of his death, his servant, aged 15, who had nursed him, took ill, and died in two days. Two children in the house did not take it, though their father was nursing them at the beginning of his illness; nor did his wife. Mr. H. has had several cases where diphtheria has not spread, though there has been communication with children. *E. g.* At Christmas 1857 a servant girl from Brighton, notwithstanding Mr. H. cautioning against it, came with diphtheria to her home at Buxted, where there were three children,

aged five to fourteen. None of them caught it, though they were constantly near her. They had all had it a few months previously, and, the cottage having three rooms, they did not sleep together.

The great illustrations of spreading have been in crowded families; but Mr. H. has also seen several members affected in unexceptionable houses.

He thinks that overcrowding very much influences the disease.

It began in the workhouse; but there was no death there. The sick were separated, and care taken to ventilate.

6. *Symptoms?*—Epistaxis was in one or two cases. Some cases began with chilliness; pains in limbs; some with sore throat, as first complaint.

Mr. H. saw no eruption, except spots that appeared petechial, generally on the extremities, in the last stage of the disease. In one case his attention was drawn to this, by suggestion from friends of the patient, that she, aged 17, had scabies; for she was itching much, and there were these spots (from size of pinhead to that of fourpenny piece) seen on legs and arms; but, probably, also, on the body (which itched) and on arms. She died, after 48 hours' illness, and this was six to eight hours before death. She had "plaster of Paris" exudation all over roof of mouth. The eruption was not close together; did not seem to raise skin; was not rough; colour was a kind of bruisy red. In one case, a family of several persons was brought to workhouse; two had slight true diphtheria without eruption; the third, a girl aged 15, had inflamed throat, with raw spots on the arches of the palate, and an itching eruption on chest and extremities; not so dark as in the former case; more like first spots of measles, with rather more vivid and scarlatina-like color. She made a tardy but complete recovery; her eruption was probably out a week. All three patients slept together. There were no cases in which the skin has desquamated.

Mr. H. had probably six to eight cases of anasarca; one of them died, he believes, with hydrothorax. He cannot say with certainty that they had had the "plaster of Paris" exudation in the throat; probably not; for where the posterior fauces were thoroughly plastered, and there was fœtor with discharge from the nose, all died.

In some cases there has been considerable suppuration below the jaw; never discharge from the ear, though ear ache.

Mr. H. had three cases of strabismus, with impaired vision, after diphtheria.

In some cases he found great scantiness of urine. Troublesome cough continued in some cases; sometimes with expectoration of a bronchial cast.

7. *Treatment?*—Mr. H. discontinued escharotics, finding them useless.

Information obtained from Mr. Prince of Uckfield.

MR. PRINCE.

Believes in identity of scarlatina and diphtheria. A brother, living a quarter of a mile off, visited a sister who had diphtheria without eruption. Ten days after he had scarlatina, which ran its usual course. Three children of a woman living in a tenement under the same roof with the diphtheric sister fell ill with scarlatina about the same time as the above brother.

One boy in a family had diphtheria; 10 to 14 days afterwards two others fell ill with scarlatina.

One moribund diphtheric patient (adult) had eruption on legs during the last hours of life; continuous on calves, spotty in front. Mr. P. thought it a scarlatinal eruption.

Information obtained from Dr. Bryden of Mayfield.

DR. BRYDEN

1. *District?*—Population a little over 3,000, on about 13,000 acres. Mayfield high, having a good deal of clay, over sand and gravel. Bronchocele prevails extensively; only with females. Probably there is no ague. District is remarkably subject to fever (but not for the last twelvemonths) especially near Calkin's Mill and in Back Lane, where there was a fierce epidemic in 1857. In the latter of these spots, the sanitary conditions were as bad as could be, but have since been improved. At Calkin's Mill there has been one case, and in Back Lane three cases, of diphtheria; for the circumstances see below.

2. *Course of Epidemic?*—The first great outbreak of diphtheria was in 1857, summer and autumn.

3. *Concurrent Diseases?*—During the winter (before the late well marked diphtheria) there was a great deal of inflammatory sore throat; and Dr. B.'s assistant says that there were cases which, after a week of apparently common inflammation, would become true diphtheria.

A good many oxen, chiefly last year, have died, what the farmers call "struck;" they fall off their feed, look dull, and then get gangrene along the spine, or of a leg, and die.

4. *Predisposing Circumstances?*—The disease has been scattered over the whole district, and has affected well-to-do people, living in quite well-kept premises. Dr. B. has never been led to associate its prevalence with any kind of sanitary ill-condition.

5. *Communicability?*—A servant girl came from near Tunbridge Wells with diphtheria to a house in Back Lane. As she was recovering two of her sisters took the disease. There were no other cases in the lane.

Dr. B. saw a very bad attack of diphtheria supervene on pneumonia in a man of about 60, who had been keeping his bed certainly for 10 days, and with no other diphtheria in the house.

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6. *Symptoms?*—A diphtheric child at the breast, under 10 months' old had eruption on limbs and chest somewhat like that of measles; distinct spots, slightly raised; they were out for two or three days when the throat complaint was at its height, viz., marked diphtheria and fœtid irritative discharge from the nose; the child recovered. The mother did not suffer then, but has quite lately had diphtheria slightly. The child had some sort of rash, which his mother thought to be measles, about a fortnight before the throat attack. At this moment also the child has an attack of eruption which the mother also thinks may be measles, with vomiting and purging of bloody mucus. This is the only case of eruption seen by Dr. B.

7. *Treatment?*—Dr. B. thinks that where guaiacum is employed early it has a wonderful effect in stopping the morbid action. To a child he gives gr. v., to an adult gr. x., every two or three hours, latterly in combination with chloride of soda. See Brit. Med. Journal, Nov. 1857, and a year later. The cases were then called cynanche maligna.

Information obtained from Dr. Monckton of Brenchley.

DR. MONCKTON.

District?—Parishes whose general position is high, with some low points, and which run down to and commence a large valley tract, containing the South-eastern Railway and river Medway, traversing the county of Kent. As a district it is dry; perhaps not sufficiently porous; sand and clay presenting every variety of aspect. Rather thickly populated for a country place. Very fairly drained and cultivated. Provisions cheap; employment plentiful; wages good; dwellings above the average, with room of course in many places for improved sanitary arrangements. Water usually from surface springs, or wells supplied from sand rocks below wealden clay. Not naturally liable to ague or endemics.

Course of epidemic?—In the autumn of 1857 first cases of diphtheria occurred. The epidemic continues now, May 1859. There were about 250 cases in a population of about 5,000, from which are recorded in books of registrar 34 deaths. There is a tradition to the effect that 17 years ago very many children were carried off by a form of throat disease much resembling those cases in the present epidemic which are the most strongly characterised by glandular enlargement, and which especially invite the name of cynanche maligna: the topographical progress of the disease in the two cases seems to have been very similar; on each occasion it started from the same quarter, lingered in the same spots, and travelled in the same direction: there is, however, no clear evidence of membranous formation in the previous epidemic.

Concurrent diseases?—There were scattered throughout the diphtheria visitation an unusual number of simple sore throats; and scarlatina, not very malignant in its form, prevailed greatly

and steadily therewith. The co-existence of the two it was impossible not to remark. No erysipelas; no puerperal fever; no common continued fever.

Predisposing circumstances?—Cases occurred everywhere; but it was by far more frequent and fatal in dark, foul, and ill-ventilated dwellings. The disease seemed to increase rather in severity than in frequency from insalubrity of its birthplace. Three families lost three children each, and in every one of the dwelling-places chronic stench was strongly marked. Dr. M. came to believe that an almost certain prophylactic against the entrance of diphtheria into a house is to be found in perpetual floods of fresh air.

The lower and lowest classes were almost exclusively affected; a few cases among tradespeople; almost none among the rich; not one affluent victim in the 34 deaths.

The disease was far more common under 13 years of age, and more frequently fatal under eight. It most unquestionably did follow scarlatina.

Communicability?—Many single cases in large families did occur, while in other instances its communication from a single individual to brothers or sisters successively was unmistakeable.

In an entirely isolated farmhouse, the occupants of which were father, mother, and eight children, the following occurred:—Mother confined Feb. 20, 1859; at usual visit that day week, viz., Feb. 27, I was requested to examine the throat of eldest daughter, aged 22, who had been ailing four days, she was ill and weak, but still occupied with domestic duties, and the fauces presented clear and unmistakeable diphtheritic deposit, tongue loaded, breath impure; arg. nitr. freely, calomel gr. x. stertim; under this and other treatment she slowly improved, becoming convalescent about March 8. There was at this time no diphtheria in that neighbourhood. On March 4, i.e., five days after I had seen the patient above cited distinctly suffering from the disease, her brother, aged six, was taken ill, and got worse and worse, but through the negligence of parents, who are fatalists, I was not sent for till 14th, and found him dead. A widow, living near, assisted to nurse this boy, and laid out the body; on the third day from the death she became ill, and went through, in a cottage some fields distant, a mild attack of the disease. During illness of the boy aforesaid two girls were taken on March 9. One died on March 25, the other slowly recovered. On March 17 another girl dropped, and died March 29. About the same time two others, a boy and girl, became affected, had it somewhat more mildly, and recovered.

The two points here are, first, the almost manifest way in which the single case of eldest daughter became the starting point for others after an interval from her own seizure of nine days; and secondly, the equally almost manifest way in which a nurse living a quarter of a mile off became infected with the disease at the house in question, but suffered it at her own dwelling.

In Feb. 1859, in another parish where diphtheria was not then prevailing, I was called to see in the last stage of it a young man

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who died next day; five days after, his sister, who had nursed him sedulously, suffered an attack, but recovered; no other cases thereabouts occurred.

There was no evidence that either the young woman who commenced group 1, or the young man who commenced group 2, derived their attack from other infected parties. Each case, however, was the first in its neighbourhood, i.e., in a district the radius of which may have been two miles.

Symptoms?—Dr. M. found often numerous separate spots of exudation, tending either to die out or coalesce; tonsils spotted over at follicular orifices like tassels on a cushion; mulberry appearance barring the colours. These cases are the mildest, membrane rarely becoming solid. Sometimes the diphtheric inflammation may almost be said to begin in and be confined to the air passages, so that but for the accidental occurrence of small portions of membrane in sight the case would be called croup. Dr. M. lost a patient last week aged 3, in a condition that would to a certainty have been called croup two years ago, but the child, no doubt took diphtheria of a playfellow affected with it, the preceding week, and showed conclusive patches in and about fauces; but death took place entirely from tracheo-laryngeal suffocation.

Congestion of the kidneys may come on two or three weeks after apparent recovery, and bring dropsy in its train. Such a case occurred in a boy aged 6; he had anasarca and pleuro-pericardial effusion; he slowly recovered. Some cases were followed by impaired vision, some by deafness, some by nervous pains about ear and temporo-maxillary articulation, and, most frequent of all, by impaired power of deglutition. By this Dr. M. has been driven to use the stomach pump 16 days after apparent convalescence: the patient, a strong young woman, died apparently from paralysis of œsophagus and cardia. Purpuric hæmorrhage from nose and mouth in two cases. Dr. M. saw only in one case cutaneous eruption; bright small red patches on the third day; not capable of being mistaken for scarlatina.

As regards prognosis, Dr. M. states that early enlargement of glands and early dyspnœa are symptoms of unfavourable omen; and that cases commencing with a tassel-like efflorescence on tonsils themselves, making these organs look like strawberries, and marking the lobulated character of their surface, are much lighter than those wherein the first deposit is of a more diffuse or solid form. No doubt patients after puberty have a better chance than in childhood. He thinks that where cases occur en masse (many in a family) the fatality is greater than in an equal number of isolated ones. The 34 deaths before mentioned were largely made up of cases where 2, 3, and 4 had died in the same family.

In a communication still more recent than the above, Dr. M. affirms that diphtheria still prevailed in his neighbourhood through the 10 months following May 1, 1859, though the cases were less frequent and of diminished severity. In by far the majority albuminuria, if steadily sought for, could be found. He dwells upon the close resemblance to croup that is frequently

assumed; though some fœtor of breath, some swelling behind the jaw, and some, though slight, visible exudation about the fauces, will render the diagnosis almost always sufficiently certain. On the point of contagion Dr. M. remarks, that on three distinct occasions, during this period of 10 months, he has seen the disease attack successively a child and its nurse, or vice versa, the nurse first and child after; in each instance an interval of about five days elapsed between the maximum point in the first and the decided onset of the succeeding attack. Thus a child would continue to grow worse and worse under an attack till the sixth or seventh day, and about the fourth or fifth day after that its constant attendant would fall ill. On one occasion out of the three the order was reversed; nurse being attacked first, and after the same interval child followed. Great stress is also laid on the necessity which exists (when instituting comparisons between rates of mortality under this head as between different localities or in different seasons, or when in any way dealing with the statistics of the subject) for making large allowance for errors of nomenclature in recording the cause of death. Dr. M. affirms that out of about 70 fatal cases occurring to practitioners in town and country, and the particulars of which he has been able more or less accurately to trace, 13 can be cited by name as having been certified to registrar as cynanche maligna, croup, or scarlatina. Dr. M. confesses to three of the misnomers as having been made by himself in 1857, when the disease first came under his observation.

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DIPHTHERIA IN METROPOLITAN DISTRICTS.

Notes by Dr. Gull, Physician to Guy's Hospital.*

Communicability of Diphtheria.—In two instances, houses seemed to retain the infecting cause. In each case, a child had

DR. GULL.

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* The following letter from Dr. Corbin, of Guernsey, in reply to my inquiry respecting the outbreak of the disease in the Island of Sark is important. Sark is about two square miles in extent; it has no land nearer than Guernsey, which is twelve miles off. The inhabitants have but little communication with the neighbouring island, so that the course of contagion is mostly distinct:—

"My dear Sir, "Guernsey, July 22, 1859.

The only cases of diphtheria which have as yet occurred in Sark are five (mother and four children, all fatal) at Vaudin's cottage, and three (children, one fatal) at the Seigneurie. In the first cases there is no proof whatever of contagion, in the latter the case is not quite so certain, Mr. Collings, the Seigneur, having entered Vaudin's cottage, and remained there about a quarter of an hour, before his children were taken ill. There exists, therefore, the possibility of his having carried the contagion to his children. Both houses are situate on the slope of a hill, which forms the side of a ravine, running in a south-westerly direction to the western coast of Sark, the side looking towards Guernsey. The houses are about a quarter of a mile apart, the cottage, when the disease first appeared, being lower down than the Seigneurie. This is well sheltered by the slope of the ground and by large trees, but part of the lawn, and the gable (where the nursery windows open) are exposed to the wind blowing up the ravine. The cottage is also sheltered from the north east, north, north-west, and west, but otherwise exposed. Between these two houses are three ponds, that nearest the Seigneurie offensive, from the number of ducks and geese that frequent

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died of diphtheria; the rest were sent away, during the time thought prudent, as a safeguard against infection; and remained well, but on their returning home the disease reappeared, and fatally. [Whilst writing these notes another instance of the same has occurred to me.]

In most cases, when diphtheria occurred where there were many children, the disease affected several. Better evidence on this will come from practitioners who know the whole circumstances of their patients.

In one family, at Haverstock Hill, diphtheria was fatal to one child; no others were affected, though there were several in the house, and no separation.

In the Licensed Victuallers' School, one child only was slightly affected, after a fatal case; the others, amounting to 50, remained well. The boys, about 70, on the other side of the house, were quite free.

In a school at Barnes a fatal case occured. Two children, removed on this account, either carried the disease or contracted it afterwards and died; those remaining behind were unaffected. A servant in the establishment and the music mistress were slightly affected.

If the disease be contagious, it certainly has besides very frequently a sporadic origin.

In many, indeed in most, of the first cases it could not be conjectured how the malady had arisen in a family, except, in some, by exposure to cold. This, though a vague cause was often as distinct as in common croup.

It is also noticeable, with reference to the question of contagion, that patients ill of other disorders, and so placed as to be out of the sphere of the direct contagion of diphtheria (if such there be), not unfrequently became affected with the disease. Of this I saw three instances;—one, a gentleman, aged 65, at Clapham Rise, confined to his room with bronchitis; a second, a lady of near the same age, living in the Kent Road, confined to her bed with rheumatism; and a third, a gentleman, aged 56, having morbus cordis, living at Barnsbury. These patients had not been in a position for contagion, and none of their friends were affected. The disease was in these cases well marked, and of that general kind which affects the lips, cheeks, tongue, and palate, and not the more severe faucial form.

If it should be proved, as to me from experience seems probable, that diseases arising from ordinary conditions, as pneumonia, cynanche, &c., were modified and became diphtheritic

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it, and also from the mud being stirred up by cattle wading in it; in the next gold fish thrive very well; the third, near the cottage, is small and covered with luxuriant watercress, and surrounded by tall willows. When the first cases occurred the wind was generally east or north-east. I ought to state, that when Vaudin's children were taken, the sun was very hot and the wind cold. I have been told that cases of diphtheria have occurred in Guernsey, but as yet I have seen none, nor has Dr. De Lisle.

"Dear sir, yours very truly,

To Dr. Gull. "M. A. BAZILLE CORBIN."

under the "genius anni," as Sydenham calls it, then it would be further probable that diphtheria had rather an atmospheric than a somatic origin, was rather endemic than contagious. In three other instances which occur prominently to me, besides those I have just referred to, this diphtheritic modification was probable.

A young girl, aged 15, was taken with acute pleuro-pneumonia. The diphtheritic relations of the disease were not suspected until the fauces and inside of the cheeks were found covered with the membrane. The onset of the illness was plainly traceable to wet and cold, and no doubt the local inflammation would equally have arisen, whether diphtheria prevailed or not, yet when it set in the evidence of the diphtheritic modification was unequivocal.

A second case was similar, but with what seemed to me still greater modification. A woman was admitted into the hospital, dying of pleuro-pneumonia. After death the fauces were found covered with the diphtheritic exudation, and, in addition to the pleuro-pneumonia, the meninges of the brain and cord were in a state of suppurative inflammation, the subarachnoid space being full of soft purulent lymph.

In a third case, a female, aged 28, with acute pneumonia, the tongue, lips, and fauces were covered with diphtheritic exudation.

In cases of scarlatina it was often observed that during convalescence the mouth and fauces became covered with diphtheritic exudation.

The second case here given seems to belong to endemic spinal meningitis, described by the French.

Locality of Diphtheria.—The localities in which I have seen diphtheria have been generally rather open and exposed. In only two instances could the malady be attributed to improper drainage and ventilation.

The following are the principal places in which I have seen cases of the disease:—

1. Licensed Victuallers' School, Kennington Lane. One case in 1857. Girl aged 11 (?), fatal on the 5th day. No second case. This was a very severe form of the disease, with extreme effusion of fibrin on the soft palate.

2. Lower Road, Islington. House close; drainage imperfect. Two daughters and mother died in a week. The details of the cases sent by me to Dr. Ballard, the Medical Officer.

3. One fatal case, a boy aged 12, in Lee Park, Blackheath. At the time of its occurrence the nature of the case was doubtful; but from cases seen before and since it was in all likelihood diphtheria; ventilation and drainage apparently good.

4. One case, recovery, male, aged 30. Clerk in city; residing at Counterhill, Deptford. House small. Ventilation and drainage good. Wife near her confinement. No extension of the disease.

5. One fatal case. Shooter's Hill Road, Blackheath. Venti-

lation good. No evidence of imperfect drainage. Suspicion of contagion, as this boy was a schoolfellow of No. 3.

6. Family of several children, Shooter's Hill Road, Blackheath, variously affected; one child died of the sequelæ. Situation of house good. No evidence of imperfect drainage.

7. Two cases, in a house near Dacre Terrace, Lee. Both recovered. Drainage not good.

8. Family at Belmont, Lee. Suspicion of contagion from school. House in which child lived, excellent. Drainage apparently quite good. No fatal case, but disease severe.

9. Family at Pembury Road, Dalston. Position and drainage of house good. Two fatal cases.

10. Queen's Road, Dalston. Small house. Ventilation and drainage not obviously faulty. One severe and fatal case.

11. Family of Mr. Holt. House situate in its own grounds, Corner of Seven Sisters' Road, Tottenham. Two cases fatal; three others recovered. Ventilation and drainage inquired into, and apparently all that could be desired.

12. One case, Camden Road, Holloway. Recovery. Ventilation and drainage good.

13. One case fatal. St. John's Park, Haverstock Hill. Drainage and ventilation unexceptionable.

14. Fatal case, three miles from St. Alban's. House detached. Situation open and exposed. No apparent source of miasma.

15. School at Barnes. Two or three fatal cases. Cellars of house seemed to be damp. Soil, gravel. Ventilation, good. The first fatal case occurred in part of house newly built. Drainage said to be good.

I might add other instances in or near the localities I have named. I have seen three cases near my house, but they occurred in children who fell ill of the disease in the suburbs, and were brought home to be treated. The conclusion I have formed from the cases I have seen is, that an exposed locality is as liable to diphtheria and perhaps more liable than more sheltered spots. I have also noticed the malady in its milder forms (sometimes in its severer forms) to come on in the course of other maladies, and when I could discover no local conditions which determined this.

Symptoms of diphtheria.—Qu. 6. In several cases the condition of deglutition (amounting often to total inability to swallow even fluids) indicated that the mucous membrane of the œsophagus was the chief seat of the malady. In the case of a gentleman, I saw at Counter Hill, Greenwich, there was scarcely any faucial affection, the disease seemed to be seated principally at the commencement of the œsophagus. The fauces were injected, but there was no exudation; the finger, passed into the lower part of the pharynx, discovered a thickened and obstructed state of the part. Any attempt to swallow even a small quantity of fluid was followed by ejection of it through the nares. The case after a time recovered. In another case, under the care of Mr. Burton of Greenwich, the fauces were not noticeably affected. The principal trouble was difficulty of deglutition, followed (as if by

extension of the disease to the stomach,) by uncontrollable vomiting and rapidly fatal exhaustion. The abdomen remained soft and rather collapsed. From these and other cases it seemed that the diphtheritic process might primarily locate itself upon the lower part of the pharynx or in the œsophagus, and thence extend to the stomach. Unfortunately in the fatal case alluded to, no post mortem examination could be obtained.

I saw the disease in several cases begin about the external nares, and extend to the lip and inside of the cheek.

In one of these the affection of the lip approached in appearance that of the "*pustula maligna*."

There were other children in this family affected with diphtheria in the more usual form.

In one child of a family where four were affected the fauces presented the disease but slightly, but simultaneously with the affection of the throat the inguinal glands became swollen and inflamed, and suppurated, and formed such a bubo as occurs in some bad cases of scarlatina. This child had had scarlatina a year previously.

In addition to *g* in Qr. 6 I would add, that the disease may be complicated by meningeal inflammation of the brain and cord, as noticed in a case alluded to in the remarks on the communicability of the disease.

In addition to *d* it may be added, that the cellular tissue not only became infiltrated, but that the skin of the neck and upper part of the chest became purpurous. In one case, with purpura about the neck, there were numerous spots of purpura hæmorrhagica over the body, with offensive bloody ichor running from the nose. There was in this case no evidence of the presence of scarlatina. The child had also had that disease a year previous.

f. In some cases the urine was not found to be albuminous. In the fatal cases it was so, so far as I had an opportunity of noticing.

It was remarkable that in no case, even when the urine was all but suppressed, and what was passed was so coagulable as to solidify by heat, was there any *renal coma.*

In the specimens of urine examined by me, though the albumen was abundant, the amount of the red corpuscles was not such as to tinge the fluid.

On the prognosis in diphtheria. The condition of the membrane, and its seat.—I observed three varieties of the exudation (α) :—the tough purely fibrinous form, which, examined by the microscope, had simply the characters of buffy coat; (β) the above, with exudation cells intermixed, as in the exudation from an inflamed serous membrane; (γ) less tough and compact with only here and there fibrillated fibrine, the most part being granular with epithelium, nuclei, and the mycelium and sporudes of a fungus.

The first form was attended with swelling of the cervical glands and of the submucous tissues. It was generally limited to the fauces.

The third form was more common when diphtheria affected adults, and especially those who were labouring under other complaints. It was often mistaken for aphthæ, from which it differed by the broadness of the patches and the ease with which they were detached. Moreover, aphthæ are often a fatal sign, whilst this superficial and general (as regards the mouth) form of diphtheria generally ended favourably. I saw several errors in diagnosis and prognosis in this matter, during this spring (1859).

The prognosis in diphtheria depended, *firstly*, upon the seat of the disease, the faucial form being the most dangerous; *secondly*, upon the quality of the exudation, that being the most formidable where the exudation was the more tough and simply fibrinous; *thirdly*, upon the condition of the pulse; *fourthly*, upon the state of the urine. When the symptoms were otherwise apparently mild, the presence of albumen in the urine has generally (universally in my experience)* indicated a fatal termination.

Relation of age to diphtheria.—I have noticed that when a family has been struck with diphtheria, the younger children have sickened first. Indeed, where, as in most families, there is free intercourse between children and adults, I have not seen diphtheria begin in one of the adults, except when it has occurred in a complication of some previous disease.

Relations of scarlatina to diphtheria.—I saw diphtheria come on in a child recovering from scarlatina. The case was rapidly fatal.

In other instances, the previous occurrence of scarlatina, whether recent or at some time distant, did not seem to exert any influence on the susceptibility to diphtheria. In only one locality had I any evidence of scarlatina being prevalent at the time diphtheria was so.

Did other varieties of sore throat prevail, &c.?—Whether from apprehension caused by the presence of the epidemic, or whether from the natural increase of affections of the throat, certain it was that during the past winter patients applied in unusual numbers on account of slight (often marked) injection and sometimes œdema of the mucous membrane of the fauces, especially, I noticed, of the mucous membrane covering the palato-gloss. and palato-pharyng. muscles. In most of these cases there was no exudation. In several there were spots of a cheesy look and consistence, filling the orifices of the follicles of the tonsils.

The fatal issue of most cases, when the urine was coagulable, may explain why anasarca did not follow diphtheria; at least no case of anasarca has, I believe, come under my notice as due to diphtheria.†

Sequelæ of diphtheria.—The sequelæ of the disease have been, in my experience, anæmia, and various nervous affections of a paralytic and anæsthetic kind; general paraplegia; partial paralysis of the muscles of deglutition; anæsthesia of extremities, &c.

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* I have since seen several exceptions to this.

† Cases of anasarca following diphtheria have been reported to me.

The peculiar nervous sequelæ of diphtheria have arrested my attention. I first noticed them in a short communication to the Lancet in July 1858. The pneumogastric branches seemed principally to suffer, and next the cord itself. The nervous symptoms supervened as the patient was otherwise convalescent. They followed some of the mildest cases. In young women I have known the symptoms considered to be hysterical, their relation to the previous affection of the throat not having been recognized. There was in some of these cases a peculiar sensation, as from fine dust or some other soft substance in the throat, and inability to swallow. The difficulty of deglutition was sometimes greatest with fluids, and sometimes with solids. The former was connected with an affection of the laryngeal branches of the nerve; the latter with partial paralysis of the œsophageal branches. This distinction was further evidenced by the quality of the voice, which was altered when the difficulty of swallowing liquids was most troublesome. The spinal disturbance varied from mere anæsthesia of the hands and feet to general paraplegia. The sphincters were not affected in the cases I saw, amounting to five. From absence of any affection of the sphincters,—from the early and sometimes fatal affection of the pneumogastric,—from the affection of the upper extremities as well as the lower, from the original seat of the disease near to the cervical portion of the cord,—and from noticing in one case enlargement of the deep-seated cervical glands, with the paraplegic symptoms, six weeks after the faucial affection had ceased, I infer that in the paraplegic condition the disease extended to the upper part of the cord by continuity from the fauces.

Whatever be the explanation, it is curious that the nervous affections came on after the faucial inflammation had ceased; and were not in proportion to the primary disease. I saw general paraplegia in a young man aged 18, where the affection of the fauces was (so it was told me) very slight; so slight, that it was doubted at the time if it was diphtheria.

Amongst the boys at a large school at South Hackney one suffered from hemiplegia as he was recovering from diphtheria. Many boys were affected with the disease, but all apparently slightly. This boy, of rather a delicate temperament, suddenly complained of intense neuralgia in the left leg. This passed off after a day; it seemed connected with the femoral vein, which was rather hard, and very painful to the touch. After two days he became very restless, and after a few hours completely hemiplegic on the right side, including the face, and speechless. I saw him at this crisis. The action of the heart was most tumultuous, and the sounds muffled. I was led to suppose that some endocardial inflammation was set up, and that probably obstruction from local coagulation of blood in the cerebral vessels was the cause of hemiplegia. By the freest use of wine and ammonia the child rallied; but the hemiplegia remained for many months; after which there was slow improvement.

My attention had not, when I saw this case, been drawn to the albuminous state of the urine in diphtheria. It now seems to me

not improbable that the endocardial inflammation may have been due to defective elimination; but at the time I saw the case I referred it rather to the direct action of the diphtheritic cause upon the crasis of the blood.

State of the urine in diphtheria :—

Pale, without obvious deposits; often albuminous. In the extremest cases of albuminuria, not sufficient blood corpuscles to tinge the fluid. Under the microscope exudation cells clustered into casts and free blood corpuscles.

Urine often scanty; in one case scanty and excessively albuminous, and then totally suppressed.

Hæmorrhage in diphtheria :—

I have seen purpura, epistaxis and bronchial hæmorrhage in diphtheria.

The purpura was principally observed about the integuments of the throat, but sometimes this was accompanied with purpura hæmorrhagica over the body.

The epistaxis seemed to be due to diphtheritic inflammation of the lining of the nose and of the back of the fauces, as was evidently the bronchial hæmorrhage from inflammation of the bronchial mucous membrane. I saw a severe example of this bronchial hæmorrhage in a boy at Haverstock Hill. The diphtheritic inflammation extended down the air passages, and blocked up the right bronchus, so that little or no air could enter the right lung. This obstruction was relieved suddenly by the expectoration of a piece of false membrane, much like the finger of a glove. For a time there was relief, but soon more membrane was detached, and then followed a fatal hæmoptysis; or rather the exhausted powers failed during the hæmoptysis, which was fairly profuse.

In the specimens of albuminous urine I have examined in diphtheria, blood corpuscles have been scattered amongst the exudation over the field of the microscope, but never in any specimens were they so numerous in the urine as to give it that dusky colour so frequent in the sequelæ of scarlatina, and to assume the characters of hæmaturia.

Amongst *the modes of death in diphtheria* I would mention suppression of urine and convulsion.

I saw this in a child two and a half years old. The disease had lasted nine days. The urine was scanty for several days, and intensely albuminous, so as to solidify on boiling; it then became suppressed; there was constant vomiting for two days, then convulsions, and screaming, and death. In this child, for five days before death, there was erythema papulatum, and urticaria; the wheals of the latter more marked than in the rash of cholera, to which otherwise it had the greatest resemblance. Besides erythema papulatum and purpura, I have seen no rash in diphtheria.

Does diphtheria occur twice in the same person?

I have known the same patient suffer with diphtheria, and after eleven months have the malady a second time, and after the second attack suffer with amaurosis.

The fungous nature of diphtheria :—

Dr. Laycock, who supports the local and fungous nature of diphtheria, curiously enough admits that the fungus found in the exudation corresponded in his case to that found in a syphilitic ulcer in the fauces of a patient, from whom indeed he believes the malady was propagated, and yet the syphilitic ulcer presented no characters of diphtheria!

Ulceration in diphtheria :—

In one case there were found inside the lips ulcers about the size of a silver twopence, covered with tough, granular looking, adhering fibrine. The surface of these ulcers was yellow, and their edges rather raised and hard. Their diphtheritic character was shown by the state of the mouth in other parts, and their commencement and course pari passu with the fibrinous exudation on other parts. In another case such ulcerations had formed at the back of the pharynx; they had so remarkable an appearance, as to lead the medical attendant to the belief that they were of a scrofulous or specific origin. As they healed the patient became universally paraplegic (i. e. in the upper and lower extremities).

Is there diphtheria without affection of the fauces?

In three instances which I have named, the affection of the fauces, if ever present, had been too slight to arrest attention; in these the chief symptoms were referable to the œsophagus. Two died; one recovered. No post mortem examination could be obtained. Absolute inability to swallow in one case. This patient was bled twice largely, and sunk in three days. Nearly absolute inability in the second case for a time. Recovered. The third, great difficulty of swallowing for a time, and then constant efforts at vomiting.

The faucial affection may be slight; the disease showing itself chiefly in some distant part, as in inguinal bubo or pneumonia.

General symptoms sometimes precede the affection of the fauces in diphtheria. I saw this unequivocally in a boy about 10, whose brother had died of the disease, two others at the same time lying ill with it. The fauces were inspected twice a day. When this boy sickened he had a distinct rigor and quick pulse, some hours before any injection of the fauces was to be seen.

This was not usual. In general the langour, and other symptoms which accompanied the disease were already preceded by some advance of the disease in the fauces.

The sudden and unexpected death of patients in diphtheria about the time that hopes were beginning to be entertained of their recovery was a remarkable clinical fact in the history of the disease. Death in such cases seemed to result from syncope.

It is an important consideration how far the seat of the disease in the fauces, and its extension to the structures adjacent, was the cause of this sudden termination. Injuries of the pneumogastric nerve are well known to enfeeble or even arrest the heart's action.

I have not been present at the moment of death of any patient in diphtheria, but in one boy whose case I have alluded to, and who died quite suddenly a short time after my visit, the heart

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was very feeble, and he had paroxysms of obstruction about the larynx, threatening a fatal termination, but the movement of the chest walls was so feeble that there was no sound as in laryngismus stridulus.

I have had no opportunity to make the observation, but it should be noticed whether in those cases which end suddenly the respiratory movements are previously weakened as well as the power of the heart.

The absence of delirium in diphtheria is an important difference between it and scarlatina maligna.

Treatment of Diphtheria.

The first consideration was in most cases the local treatment. Various applications were used by my direction. The results were generally unsatisfactory. It will be readily understood that unless the fibrinous exudation was first removed, whatever application was used could effect but little any way, and it is equally plain that it could not be an easy matter to detach the fibrinous layer when it extended to the back of the fauces and over the entrance of the glottis.

In the worst cases, therefore, when it seemed so urgently desirable to check exudation, and especially over those parts which bordered upon the larynx, the local application seemed to me to do but little, if any, good. When the exudation was more within reach, as over the anterior pillars of the fauces and the soft palate, and when a fair trial could be made of applications to the engorged capillaries, the result was not satisfactory. I saw the fibrinous layer detached, the solid caustic applied to the part, and yet in a few hours an equal thickness of crust formed again, and when removed, and the caustic reapplied, the layer formed a third time, and apparently as quickly as before.

In some cases the disease seemed to begin at one spot on one of the tonsils. In such cases the application of the strong nitric acid seemed indicated. Gargles of chlorinated soda were very useful for removing the fœtor of the decomposing exudations; but beyond this, and the advantages of a mechanical kind from the removal of any large amount of fibrinous exudation, so as to enable the patient to swallow or breathe better, I did not see any decided good in the applications, whether of chloride of zinc in solution, muriate tincture of iron, the solution of argent nitr., or the solid caustic by hydrochloric acid, &c.

Of course I do not deny that both practitioners and patients were amused by these apparently direct means of controlling the malady, but I could witness no really therapeutical results. On the contrary, I think I saw in several instances the local inflammation aggravated by violent interference with strong caustic applications.

Nor were external appliances to the fauces attended with any better result. Hot fomentations rather exhausted the patient. Blisters seemed inert.

It was, as above stated, sometimes necessary to remove the fibrine on account of its mere bulk. This sometimes entailed much hæmorrhage from the engorged and softened capillaries. In such cases the application of some astringent with a sponge or camel hair brush was useful.

Therapeutics.—The failure of local applications was to be expected where the conditions prevented their strict employment, and where the tissues were affected so thoroughly as they were in diphtheria. According to my experience, their only use was as disinfectants, to correct the fœtor from decomposition. What further was necessary could be accomplished by mechanical means, and these required the greatest gentleness, since any violence added to the trouble of the part.

I saw, in one case, antimony given to produce and maintain nausea for many hours, or rather for two days, after the popular method in the profession of arresting the exudation in ordinary croup. The result was unfavourable. The exudation of the fibrinous layer throughout the larynx and down to the larger bronchi was quite unchecked, and when it separated the patient sank exhausted, with copious hæmorrhage from the bronchi.

I saw calomel tried in three* cases. They were not severe, but there was in each marked croupy symptoms. The indications assumed and followed in these cases were to alter the qualities of the exudation, and to sustain the enfeebled powers of the patient. Nourishment and stimuli, as wine, were given at intervals with the calomel. All these three patients did well.

For the most part reliance was chiefly to be placed upon wine and nourishment.

Quinine, tincture of the muriate of iron, &c., has often no sort of influence over the disease, and failed to support the opinion expressed by some practitioners that they were certain in their curative operation. Chlorate of potash given in large quantities, ʒii. or ʒiii. a day, as well as in small doses, equally failed. I prescribed it often rubbed down with syrup and dissolved in milk, when it was taken freely, but I saw no result to give me any confidence in its therapeutic value in diphtheria.

In one severe case, with scanty and highly albuminous urine, in a young lady aged 18, full doses of compound jalap powder were given at intervals, and iced champagne. From the feebleness of the pulse, the condition of the urine, and the constant vomiting, but little hope was entertained of her recovery, nor did the administration of the purgative in so debilitated a condition seem without risk. The result was, however, satisfactory. The free purging seemed to stimulate the circulation and check the vomiting, which was probably occasioned by the defective action of the kidneys. The patient took a dozen of champagne in eight days.

7th qy. *d.*—Two cases of pneumonia, with diphtheritic exudation over the fauces, recovered by nourishment only, *i. e.*, including a moderate supply of wine and brandy.

* I have since seen another case of laryngeal affection relieved by the administration of mercurials, wine and support being freely given at the same time.

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7th qy. *e.*—Two cases of paraplegia (upper and lower extremities affected) recovered, one under the use of liq. hydrag. bichloridi and tinct. cinchonæ; the other whilst taking iodide of potassium in small doses. Generally, in the treatment of the nervous sequelæ, I could not observe any advantage from medicines. The recovery was tedious, and more apparently from the natural recuperative powers than by any aid afforded by art.

Change of air, in some cases, seemed to favour recovery; but this was not constant, many patients falling ill when removed for convalescence from the localities in which they had sickened.

Notes by Mr. Carr on Cases at Lee and Blackheath.

MR. CARR.

District?—It includes Blackheath and Lee—S.E. suburb of London; places having a high level; moderately exposed; light soil, gravel and sand; with a moderate amount of first class dwellings, and some poor residences. The varied forms of intermittent diseases prevail after easterly winds, charged with miasm from the Plumstead marshes. Low fever or diarrhœa is rare; bronchocele absent.

Course of epidemic?—The first cases in September, 1858; the last in April 1859, the severity of the epidemic being confined to the three former months. Under Mr. C. there were 14 cases and seven deaths; under his partner, 6 cases and three deaths. These 20 cases in 18 houses; all first-class residences.

In April 1851 Mr. C. attended three children in a brickfield hut up the Shooter's Hill Road, two of whom died, and were registered by Mr. C. (who had then not seen diphtheria) as cases of strumous croup. Post-mortem examinations of both the fatal cases were made, and Mr. C. now recognizes the disease to have been true diphtheria. In September 1855 he attended a gentleman with diphtheria, who had previous to the attack been in Paris, where the disease was then epidemic.

Concurrent diseases?—Sore throats were the prevailing diseases from September to January, and all required stimulating general treatment. They preceded, accompanied, and followed the epidemic; and it was remarkable that when an individual member of a family suffered from diphtheria all the others were more or less the subjects of some form of throat disease, and always of a low type. No fatal case of non-membranous sore-throat occurred in Mr. C.'s patients, yet several were of a dangerous form. There was no epidemic scarlatina. One or two mild cases during the diphtherial epidemy.

Predisposing circumstances?—As a rule the cases occurred in dry and airy districts; but in all Mr. C. believes there were local causes in operation. Mr. C. knows of no case which occurred in a well drained and well-ventilated house. In several cases low type diseases had prevailed; in others the houses were of recent construction, with cesspool drainage, and this in defective condition. In all the cases which came under his observation the

individuals attacked were in affluent or comfortable circumstances. The greater number of his cases occurred in children under 10 years old; generally delicate, and of strumous diathesis. He can trace no connexion between scarlatina and diphtheria.

Communicability?—In several cases a single child had fatal diphtheria in a house where other children resided; but, as a rule, intercourse was cut off from direct contact. In other instances several members of a family were attacked; the first case proving fatal; the second and subsequent less severe; rarely the domestics, living in the lower or ground floor rooms being affected.

Mr. C. knows of no case occurring as the result of human communication, neither has he seen any proof that the disease could be transmitted by intercourse.

Symptoms?—In all cases, watched by Mr. C., glandular enlargement measured the danger. Bleeding from the nose and bowels too are signs of great importance. Sanious and purulent discharges from the nasal cavities usually precede a fatal termination. The febrile symptoms are generally very slight; the depression grave in proportion to the danger of the case.

Albuminous urine is often met with, but not always; when, however, it does exist, it may be detected in the earliest stage of the disease (herein differing from scarlatinal albuminuria) and, as a rule, is cumulative.

Beyond a slight redness Mr. C. has seen no skin affection. In all his cases the skin felt cool.

The extreme suddenness of death is one of the most marked characteristics of true diphtheria, occurring in an instant when the patient has the power of sitting up in bed, of speaking, and of swallowing; these conditions may exist, too, after the pulse has ceased to beat for an hour, and yet consciousness remains.

In three of Mr. C.'s patients the blood was found black as ink and fluid. The skin and muscular tissues bloodless. The mucous membranes of the mouth, throat, larynx, and trachea more or less coated with false membrane in a state of decomposition, and easily removed from it, the membrane itself being found somewhat softened, but intact and normal. No attempt of organization of the false membrane.

NOTES ON MORBID ANATOMY OF DIPHTHERIA, EXTRACTED FROM TRANSACTIONS OF PATHOLOGICAL SOCIETY OF LONDON.

(*Mr. Simon, Feb.* 15, 1859.) A. H., æt. 13, had been suffering from diphtheria for 19 days before his death, and during the last 11 had been under treatment in St. Thomas's Hospital. On the 8th day of the disease a large mass of thick, dense, very fibrinous false membrane detached itself from the fauces, leaving the surface of the tonsils and soft palate raw (like that of skin from which the cuticle has been removed after blistering) but not ulcerated

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or sloughing. On part of this surface, a second thinner false membrane soon formed, and subsequently came away in shreds. There was irritating discharge from the nose, and during the last days of life some of the patient's drink escaped this way. Early in the disease there had been swelling below the jaw, but this had subsided many days before death. On the 17th day of the disease superficial ulceration began at the left tonsil, and on the 18th day had extended to the size of a shilling. On each of the last 11 days of life the urine was examined; it always gave abundant precipitate with nitric acid, and latterly also with heat; but in the earlier days it precipitated imperfectly with heat, and largely with acetic acid. Microscopically it showed fibrinous tubule-casts, containing traces of hæmorrhage, but scarcely any renal epithelium. Throughout the progress of the disease the patient was pale, feeble, and disposed to be chilly, so that wine and much external warmth had from the first been necessary. The tongue was always moist. No eruption appeared upon the skin. There was no delirium or stupor, and neither cough nor any sign of laryngeal obstruction was observed. The respiration was natural till within a few hours of death, when it became short and hurried.

The following were the post mortem appearances:—With exception of an occasional very delicate film, there was no false membrane about the fauces. In the situation of the left tonsil was a sloughy ulcer, somewhat larger than a shilling. The posterior surface of the soft palate was congested, and there adhered to its somewhat swollen mucous membrane small patches of false membrane. In the recess of mucous membrane beside the epiglottis was an irregular depression, evidently the remains of an almost cicatrized ulcer. About an inch below the aperture of the glottis, the pharynx presented on its right side a small circular ulcer, about two lines in diameter, with somewhat raised margins, and on the left side another similar ulcer, about the size of a pin's head. In other respects the pharynx and œsophagus were healthy. On washing out the nares, a strip of false membrane an inch in length was removed. The mucous membrane covering the septum showed patches of congestion, was thickened, and had shreds of false membrane adherent to it. Both lungs, except in their upper and anterior parts, were greatly congested with blood, and less crepitant than is natural. Especially the lower lobes, in their posterior parts, were in many places nearly or quite without air; and the most solidified portions broke down on firm pressure with the finger. At one section the exuding fluid was obviously purulent, and microscopical examination showed pus extensively in other parts of the hepatised structure. The bronchial mucous membrane was a little injected; the tubes contained thin frothy fluid tinged with blood, or more tenacious reddened mucus. The kidneys were large, and intensely congested. Sections of the cortex, microscopically examined, showed frequently the presence of large transparent colourless rods of apparently fibrinous material, soluble in acetic acid and liquor potassæ. These rods were sometimes floating free, sometimes partly or wholly held within urinary

tubules, of which evidently they were casts. They were generally structureless, but (no doubt, from the manner of their formation) had a disposition to transverse fracture, and sometimes presented lines curving almost concentrically across them, or had this direction given to little clusters of granular matter, probably altered epithelium, which they occasionally contained. Apart from the presence of these casts, the tubular structure of the kidney was not very obviously diseased; but, after prolonged and careful observation, it could confidently be said that, at least in many parts, the cell-growth within it was redundant, so that the tubules were more opaque than natural, and had their interior canal encroached upon or even quite occluded by an increased amount of epithelium. The Malpighian tufts within their capsules showed a little indistinctly. The venous system was everywhere remarkably full of blood; the liver was greatly congested; the heart was healthy, with a firm coagulum in each of its four cavities. The above specimens were shown to illustrate two points:—(1) the occurrence of ulceration as a secondary process in the textures which had primarily been covered with false membrane; and (2) the occurrence of internal complications in diphtheria. In reference to the first point, Mr. S. observed that, although certainly it is essential to diphtheric inflammation to be primarily not an ulcerative or a gangrenous process, yet other post-mortem examinations of diphtheric throats had shown him that their state, especially the state of the tonsil, with fibrinous and bloody infiltration of its substance, is one which might easily pass into ulceration or sloughing. In reference to the second point, he observed that, in respect of the morbid appearances discovered in the kidney, as well as of the condition of the urine during life, this case tallied with others which he had examined, and led him to believe that the tendency to renal complication is an essential part of diphtheria. He had not previously had any opportunity of examining the lungs of diptheric patients, and could not say whether pneumonia frequently existed as a complication of the disease.

(*Dr. Bristowe, April 5th*, 1859.)—*The affection of the throat* consists in a peculiar kind of inflammation of the mucous tissue, accompanied by the formation of a false membrane. This inflammation (in the early stage superficial, and originating usually in the neighbourhood of the tonsils and on the back of the pharynx,) may extend either in depth or surface. In the former case not merely may it involve the sub-mucous tissue and the substance of the tonsils—parts usually affected; but it may invade the subjacent muscles and the neighbouring glands, and include even all the tissues of the front of the neck. In the latter base it may spread over the pillars of the fauces, the soft palate cases of the tongue, and greater part of the pharynx, may, attack the posterior nares and larynx, may even pass into the trachea, and along the bronchial tubes, or finally travel down the œsophagu, and even reach the

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cardiac orifice. The false membrane presents a greyish or dirty yellowish-white tinge; is generally about half a line in thickness, but often thinner, and sometimes very much thicker; its outer surface is usually somewhat uneven and fissured, occasionally even flocculent; its deep aspect, except at the time of separation, is pretty firmly adherent to the subjacent mucous membrane, is moulded upon it, and may at times be distinctly seen to send prolongations into the mucous follicles. In consistence it approximates somewhat to that of false membrane connected with serous membranes, but is somewhat less elastic, and at the same time more friable and solid. It varies, however, considerably in these respects, and the outer region is generally more flaky, and less coherent than the deeper. On microscopic examination, it appears to consist chiefly of epithelium and coagulated lymph. The epithelium, which is that belonging to the affected subjacent membrane, seems generally pretty healthy, but sometimes more or less granular and breaking down. Nuclear bodies, in greater or less abundance, are also frequently present; these being probably either the transformed products of the mucous crypts, or the abortive epithelial formations of the mucous membrane itself. The coagulated lymph essentially resembles that poured out on serous membranes, and consists of a close network, the trabeculæ of which are refractive, and various in size and shape, but comparatively thick, and the interstices of which are minute, and irregularly polygonal in form. The meshes are so small, and the intervening fibrillæ so irregular and thick, that when seen in mass they present a pebbly appearance, suggestive of the presence of innumerable nuclei; this appearance, however, is almost always fallacious, as may be seen by examining the edge of a microscopic section; or by the addition of acetic acid, which expands and renders the whole transparent, brings no nuclei into view, but in their place an irregular, comparatively large network, which appears to consist of the attenuated axes of the now dilated and partially dissolved trabeculæ. The only distinction between the fibrinous network here spoken of, and that formed upon serous membranes, is the accidental one of size; and that this is apparent rather than real is shown by the fact, that though in the case of serous membranes the network is usually far larger and coarser, in both cases it is occasionally found much more delicate than the above description would imply. I have always observed that the free surface of the false membrane is made up chiefly of epithelium, the deep almost exclusively of fibrine; from which facts it may be assumed that the morbid process taking place at the mucous surface consists essentially in the effusion of coagulable lymph; that the first effused portion entangles the epithelial cells, and that the subsequent ones accumulate between the true epithelial layer and the basement membrane, becoming successively more and more free from entangled cells, and more and more purely fibrine. It may be added, that the free surface becomes generally mixed with extraneous matters, such as starch, milk, and muscular fibre; and may form a nidus for the development of lowly organized cryptogamic plants. The mucous membrane itself, subjacent to and around the false

membrane, is always more or less congested; and the submucous tissue, especially in those situations in which it is naturally lax, as about the epiglottis and upper half of the larynx, becomes not only œdematous, but the seat of interstitially deposited lymph; which, undergoing coagulation, presents an arrangement similar to, but coarser than, that of the false membrane occupying the free surface. When the false membrane has separated, the mucous surface is generally left whole, though delicate and tender; often, however, it is distinctly excoriated; and sometimes exhibits decided ulceration. The tonsils are usually more or less enlarged, become soft and deeply congested, present occasionally suppurating points or cavities in their interior, and sometimes become distinctly gangrenous. The inflammation does not appear to extend commonly much beyond the structures here enumerated; yet it may invade other tissues of the neck, and even, as in the case of T. N., involve the whole of the cervical region anterior to the spine. That the muscular tissue may become impaired is shown by the frequent supervention of a more or less well-marked paralytic condition of the soft palate; yet I have been unable to detect in the muscles thus affected any deterioration in their ultimate structure. The form of throat affection described, though doubtless forming an essential part of a peculiar and specific form of disease, does not itself, in its morbid anatomy, present any specific nature. The changes which take place in the mucous membrane and subjacent tissues are of the same kind as those observed in other forms of throat inflammation; and the false membrane deposited differs in no important respect from that of common croup, or from that which is occasionally seen in cases of scarlet fever, erysipelas, or even small pox.

Condition of Lungs.—The bronchial tubes are probably not generally affected; though, when the larynx and trachea have become involved, they almost necessarily get loaded with secretion, and may even, in rare cases, present an extension of false membrane. The condition of the lung-substance itself, however, is commonly, I suspect, a point of great importance, at least if I may venture to draw conclusions from the cases which have come under my observation. In two of the four complete autopsies which have furnished material for this paper (in Mr. Simon's case and in that of of M. A. F.), the lungs were found to be the seat of extensive lobular pneumonia. These organs were much more solid than natural, and studded thickly and uniformly, from apex to base, with small hepatised masses, separated from one another by a net work of crepitant and comparatively healthy tissue. The solid masses in some parts resembled carnified tissue; in others apoplectic effusions; in others, presented all the varieties of true hepatization; and in all cases displayed, both microscopically and otherwise, ample indications of their inflammatory origin. Traces of the same kind of affection were present in the case of T. N. The lungs of J. P. were the only ones that appeared absolutely healthy. Now the form of lung-affection above described (which I have frequently recognized as a sequel of laryngeal affections and of infantile bronchitis, and which is,

therefore, manifestly not peculiar to diphtheria,) is one that creeps on insidiously, is attended by none of the usual symptoms of pneumonia, and from its anatomical distribution by none, or scarcely any, of the ordinary auscultatory phenomona; yet it tends gradually to destroy a large portion of lung-tissue, and cannot fail, therefore, to operate seriously in promoting a fatal issue, and does, I strongly suspect, play an important part in producing those deaths, which occur with such lamentable frequency during apparent convalescence.

Condition of heart.—I have no reason to suppose that the heart is usually otherwise than quite healthy. In the case of T. N., however, it was not only the seat of intra-muscular haemorrhage, but in a state of well-marked, though early, fatty degeneration. These conditions I imagine to have been due to the accidental intensity of the disease, and to be explicable on the same principles as the like conditions occurring in purpura, pyœmia, scarlet fever, and other cases in which the quality of the blood becomes rapidly impaired.

Condition of kidneys.—I believe that all the kidneys, which I have had the opportunity of examining, have presented to the naked eye a healthy or nearly healthy appearance; yet all of them, that I have submitted to microscopic examination, have presented marks, more or less distinct, of disease. In some I have recognized merely slight traces of hæmorrhage into the tubes, with an occasional transparent fibrinous cast; in some I have observed, besides the above appearances, a certain degree of opacity and granularity of the epithelial contents of the convoluted tubules; and, in the most advanced examples, I have discovered granular exudation between the Malpighian capsules and tufts, a distinctly fatty and distended condition of the epithelial cells, the presence of fibrinous casts and hæmorrhagic exudation, and these not confined to the cortex, but occupying in an equal degree the medullary portion. All the appearances here enumerated indicate the presence of slight inflammation, but of inflammation not necessarily therefore unimportant, or unlikely to be followed by serious consequences.

The above description includes the more important pathological conditions which I have observed in cases of diphtheria. I may add, however, 1, (in reference to the blood), that there were fibrinous coagula even in the heart of T. N., and that hæmorrhagic exudation was not confined to the tissues of the heart and neck, but had occurred in many parts of the sub-peritoneal tissue, and in the substance of the supra-renal capsules; 2, (in reference to the skin), that I have on several occasions witnessed a measly (probably petechial) eruption, appearing generally shortly before death, and due probably to the same cause as the internal hæmorrhages, to which reference has just been made.

1. T. N., æt. 10, the son of a farm labourer, was admitted into St. Thomas's Hospital, under Mr. Solly's care, on the 12th of November 1858, with contraction of the left wrist—and elbow-joints, after a burn. On the 18th he was operated upon, and con-

tinued under mechanical treatment up to the commencement of the malady of which he died. He appeared perfectly well on the 20th of March 1859, but on that day partook indiscreetly of some gin and other improper articles of diet. The following morning he had a slight attack of shivering, and seemed otherwise a little indisposed. On the 22d he complained of slight soreness of the throat. This increased, and on the 24th the following notes were taken by the surgical registrar:—

"Throat much swollen externally, particularly on the right side. On looking into it the right tonsil is seen filling up the fauces, and has upon it a pultaceous material. Pulse small and weak, 130; tongue furred; skin cool." On the 25th he was placed under my care. He has slept a little in the night, and is said to be now rather better than he has been. He is extremely feeble however, not at all feverish, and perfectly rational. The skin is cool, and gives no indication of rash. Pulse small, weak, slightly irregular, and about 100. There is great tumefaction, hardness, and tenderness in the upper part of the throat, chiefly in the parotid and submaxilliary regions, and more on the right side than on the left. The anterior half of the tongue is clean, and its papillæ are healthy; the posterior half is somewhat furred. The right tonsil is much swollen, and covered by a thick wash-leather-like false membrane, which is prolonged from it on to the pillars of the fauces, over the right half of the soft palate, and to the edges of the posterior teeth. The nose bled this morning, and a little thin sanious fluid has continued to ooze from it. He has no pain anywhere except in throat; experiences pain and difficulty in swallowing, but can manage to take fluids. No cough or difficulty of breathing. Bowels opened yesterday. March 26th, 2 P.M. Slept pretty well, but is much worse than he was. Skin cold, without trace of rash. Pulse quite imperceptible. Throat more swollen, hard, painful on pressure, and studded on the right side with small congested points. Tongue dryish, but not much furred. The breath has a faint gangrenous odour. There is no appreciable change in the condition of the interior of the throat. He is quite sensible, but very restless. No cough, or embarrassment in breathing. He continued to sink, and died at half past 5 P.M., remaining sensible to the last. He was treated chiefly with wine, brandy, eggs, and beef tea, poultices to the exterior of the throat, and gargles, containing chlorate of potash and a little hydrochloric acid. The urine, from accidental circumstances, was not examined. No appearances indicative of scarlet fever were ever recognised; but during the progress of his fatal illness a few sores on the arm assumed a superficially gangrenous condition. There had been no diphtheria in the ward previously; but a second boy,* who ultimately recovered, was attacked with the same disease within a day or two of his death. There had been a case of erysipelas about six weeks before, and about the same time a

* See case of W. A.—Medical Times and Gazette, August 20th, 1859, page 181.

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mild case of scarlet fever. It is believed, but it is not qute certain, that the subject of the present report had never had scarlet fever.

Post mortem examination.—In fair condition. Left hand and arm much contracted, in consequence of the cicatrization of an old burn; and a little above the wrist were two or three shallow, ulcerated surfaces, covered by thin, black, depressed eschars. The front and sides of the throat were thick and brawny; and the parotid and submaxillary regions were much swollen and hardened, especially on the right side, where also the integuments were studded with congested and livid spots. On cutting into the neck, its muscular and cellular tissues, from the integuments to the vertebræ, and from the ears and root of the tongue to the upper opening of the thorax, were found indurated and brawny, and so infiltrated with blood as to be everywhere almost black. There were no circumscribed fluid or clotted collections, but the blood was uniformly diffused throughout the tissues. There was no appearance of pus, and no visible indication of inflammatory deposit. The soft palate and uvula, the tonsils and pillars of the fauces, the œsophagus and larynx, were all intensely and deeply congested, tumid, brawny, and covered in many places by toughish, adherent, ashy, false membrane, or by pultaceous puriform exudation. The soft palate was quite half an inch thick, infiltrated with blood, and studded with shreds of false membrane. The tonsils were swelled, but at the same time presented deep fissures and excavations, and were covered pretty completely by greyish-yellow false membrane. This was in parts thick, tough, and pretty firmly adherent, but over the convexity of the tonsils became changed into a soft, pultaceous deposit, which seemed partly pus, and partly superficial slough. On incising the left tonsil it was found softened, deeply congested, partly infiltrated with blood, and studded with distinct pus-holding cavities; and the surfaces of the fissures passing into it from the surface were soft, greenish, and slightly gangrenous. The right tonsil was generally in the same condition as the left, but presented several deep, distinctly gangrenous, fœtid excavations. The mucous surface of the base of the tongue and back of the pharynx was congested, and presented here and there shreds of adherent membrane. The mucous investment of the epiglottis, and indeed that of the whole larynx, were thickened, indurated, and deeply congested. The epiglottis was covered pretty extensively by a toughish adherent membrane, about half a line thick; and a similar formation, in less abundance, was studded over the rest of the laryngeal surface, and accumulated along the vocal cords. The trachea was congested, but otherwise healthy; the œsophagus also was healthy; but the tissues immediately surrounding them, like those of the rest of the neck, were infiltrated with blood. Several portions of the hard palate, and septum nasi, were removed, and their mucous covering was found congested, and lined by adherent false membrane. Pericardium healthy. Heart small, firmly contracted, and nearly empty, its auricle and right ventricle containing a

little fibrinous clot only. The valves were healthy. The muscular tissue was generally pale, but almost all the musculi papillares and carneæ columnæ of the left ventricle, with the walls of the apical half in nearly their whole area, and to a depth varying irregularly from a quarter of an inch downwards, were almost black from sanguineous infiltration. The same condition was observed in the right ventricle, but to a less extent; the papillary muscles and the parietes being studded irregularly and thickly with black blood-infiltrated patches of various sizes; some so thick as to reach the external surface of the organ, and some dotted with white spots and patches, which looked at first sight like suppurating points. Pleuræ healthy. Lungs crepitant throughout, and not materially congested. They presented, however, on their external surface, a few dark-red, almost black spots, about a quarter of an inch in diameter, which were found to correspond to small subjacent patches of solid, dark-coloured, granular lung tissue. The bronchial tubes contained much secretion. Peritoneum healthy. Liver of usual size, generally of normal colour and consistence; its surface and substance, however, were thinly studded with pete chial spots. Spleen of usual size, pale, and of moderate consistence. There was a little effusion of blood in the sub-mucous and cellular tissues around the pancreas and supra-renal capsules; and the latter organs presented patches of extravasated blood in the interior, though apparently in other respects healthy. The cellular tissue of the mesentery was studded pretty thickly with small, and not very intensely coloured patches of congestion and extravasation. The stomach and intestines were healthy, but the ileum contained two lumbrici. The kidneys were of the usual size, pale, and apparently perfectly healthy. Aorta and vena cava healthy.

Microscopic examination.—The false membrane about the fauces and neighbouring parts was made up chiefly of a network of fibrillated lymph. The fibrillæ were very irregular in outline and dimensions, but generally comparatively thick; and they coalesced with one another in all directions, so as to leave irregular spaces between them, which were small, and often not larger in diameter than the fibrillæ themselves. When seen in thickness, the tissue above described presented a pebbly character, like that afforded by an accumulation of nuclei; but the fallacious nature of this appearance was recognized on looking at the thin edge of a section; or by adding acetic acid, which rendered the whole transparent, at the same time expanding it, and bringing into view an exceedingly delicate and irregular network of well and sharply defined, occasionally bulging, fibres, which appeared to be, so to speak, the skeleton of the original network. In some places the false membrane consisted of an apparently uniform layer composed of an extremely fine and indistinctly fibrillated tissue, studded with molecular matter, and presenting something of a ground-glass character. Imperfect epithelium was entangled here and there in the substance of the membrane, but was most abundant on the

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superficial surface. The pus-like fluid in the tonsils consisted of well-marked pus-cells, characteristically affected by acetic acid. Some of the muscular tissue from the small muscles of the larynx and from those of the neck was examined, and found to be striated and healthy-looking; but the spaces between the fibres were loaded with blood-corpuscles. The cellular tissue in front of the epiglottis presented a network of fibrillated tissue, like that constituting the false membrane itself, but the meshes were larger and more distinct. The muscular tissue of the heart was found to be generally in an early stage of fatty degeneration, the transverse markings being nearly absent, and the fibres studded with minute molecules. But in the portions infiltrated with blood the degeneration was more advanced than elsewhere, the striæ were wholly deficient, the fibres crowded, and in some cases opaque, with beads of oil, many of which were of considerable size. The white pus-like spots in the right ventricle consisted simply of muscular fibres extremely degenerated. The kidneys, though looking healthy to the naked eye, were really much diseased. The Malpighian bodies were generally healthy, but a few presented accumulations of oily granules between the capsule, and contained tuft of vessels. The epithelium of the tubes was generally opaque and granular. In many instances the peripheral surface of the cylinder of cells presented numerous oily globules; and not infrequently the tubes appeared filled with separated and irregularly clustered epithelial cells, loaded with oil so as to be almost opaque. In a few cases, tubes were filled with recently extravasated blood; and occasionally transparent casts were seen floating about the field of the microscope. The contents of the medullary tubules were more generally unhealthy even than those of the cortical ones. Many contained transparent fibrinous casts, and the majority presented oily breaking-down epithelial contents.

2. M. A. F., a female servant, aged 22, was admitted in the early part of February 1853. No record of the case is preserved beyond the details of treatment. These seem to indicate that on admission she was labouring under some acute affection of the lungs, that she soon became convalescent, and was put on a course of tonics. On the 12th of March a sudden change of treatment took place; a blister was applied to the throat; a purgative was administered; a mixture containing ether and ammonia was prescribed, and wine, which had previously been administered in small quantities, was increased. This plan of treatment was persisted in, but she died on the 24th.

Post-mortem examination.—The mucous membrane of the pharynx, fauces, and base of the tongue, was covered by a layer of lymph between a half and a quarter of a line thick. Its free surface was irregular, fissured, and in places flocculent. It adhered pretty firmly to, yet could be easily separated from, the subjacent mucous surface, which was congested, here and there excoriated, but nowhere distinctly ulcerated. The lymph ceased gradually at the lower part of the pharynx, and the œsophagus

was healthy throughout. Both surfaces of the epiglottis, and the rest of the mucous membrane of the larynx, were similarly enveloped in a layer of adherent lymph. The deposit extended continuously from the superior to the inferior vocal chords, so as completely to conceal the orifices of the sacculi laryngis. On removing it, however, a prolongation from its deep surface was found to extend into the sacculi, and to form a kind of cast of them. As far down as the true vocal chords the lymph was as thick and abundant as in the pharynx; but below this it was less copiously deposited, and on the left side almost completely absent—the uncovered mucous surface, however, being much congested. The mucous membrane of the trachea was congested, and a patch of lymph, continuous with that in the larynx, extended about an inch and a half down its anterior surface. The mucous and sub-mucous tissues of the upper half of the larynx were much thickened, the epiglottis measuring a quarter of an inch in thickness; and the calibre of the larynx, though quite pervious, was considerably diminished. The lymph was of a dirty greyish-brown colour, and moderately tough, allowing of removal in strips; but its deep surface was considerably tougher than its free—the latter, indeed, being for the most part pulpy or shreddy. It was found, microscopically, to present an irregular and indistinct fibrous structure, studded with nucleus-like bodies, for the most part imperfect and irregular in shape. Pleuræ healthy. Lungs of moderate size, but firmer, heavier, and more lacerable than natural. On section they presented a peculiar appearance. They were much congested throughout, but displayed, on close examination, a peculiarly mottled aspect, owing to numerous patches of a dark colour being scattered uniformly and thickly throughout the substance of the organs, but separated from one another by a network of lighter and more healthy looking tissue. The solid patches were small, about the size of one or two lobules, generally discrete, but running occasionally into one another. They projected from the cut surface; had a dark colour, in some as black as that of pulmonary clot; were granular and solid; yielded on pressure no fluid, or at most a little bloody serum. They had more the appearance of apoplectic than of inflammatory formations, and, under the microscope, that idea seemed at first sight borne out by the vast numbers of blood corpuscles floating about, and obscuring the tissues. On washing these away, however, the cells and intercellular passages were found to be filled with nuclei. In mass these might have passed for pus. But floating about the field were many nuclei which appeared to be of the same nature; and these were round or oval, as nearly identical as possible with the nuclei in the cells of the bronchial mucus, and were unaffected by acetic acid. Moreover, when the air cells containing them were acted on by acetic acid, and compressed so as to separate the nuclei, the latter were clearly seen not to be influenced like pus-corpuscles. The nuclei had a great tendency to cohere, so that no amount of pressure availed to squeeze them from the air cells, or to separate them completely from one another. The intervening parts of the

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lungs were of a paler red, yet redder than natural, and crepitant. The bronchial tubes were a little injected, and contained much frothy serous fluid. Pericardium and heart healthy.

3. J. P., a cheesemonger, æt. 35, was admitted on the 29th of June 1852, for psoas abscess. He was treated with tonics and stimulants continuously up to the 13th of October. On that day two drachms of antimonial wine, and three of solution of acetate of ammonia, were ordered to be taken every four hours. On the 15th a blister was applied to the throat, and the same day he died.

Post-mortem examination.—Much emaciated; several ulcerated openings in the right groin. The tonsils were healthy, but the surface of the pharynx behind them was covered by a thick, loosely adherent, white, doughy-looking material. This extended in large quantities half way down the œsophagus; and in the form of aphthous patches studded the remainder of the œsophagus, and a small portion of the stomach in the neighbourhood of the cardiac orifice. The mucous surface of the pharynx and upper half of the œsophagus was extensively ulcerated; that of the lower half of the latter tube was much congested, and in many places excoriated. The interior of the upper part of the larynx, including the vocal chords, was loaded with a similar kind of material, and the mucous membrane was œdematous and ulcerated. The deposit appeared, under the microscope, to consist almost entirely of epithelium, mixed with fragments of fibrillated material, and extraneous matters accidentally present. The lower part of the larynx and trachea were perfectly healthy; the lungs somewhat congested. There was a large abscess in the course of the right psoas muscle, which communicated with the ulcerated openings in the groin, but was quite unconnected with bone. There was no other visceral disease.

MISCELLANEOUS FACTS.

Previous (contemporary) Observations of Diphtheria.

Glasgow.—"I published two short communications on what I "called croup, but which was, in fact, diphtheritis or angina "croupuli, in the Edinburgh Medical and Surgical Journal, April "1825, p. 294, and in Johnson's Medico-Chirurgical Review, "January 1827, p. 289. Notice of my first communication, "necessary to understand my second, will be found in Johnson's "Medico-Chirurgical Review, October 26, 1826, p. 436. The "disease was generally known in Glasgow at the period referred "to in these journals by the name 'croupy sore-throat.' It was "very fatal, attacking in succession several children in the same "family, and was presumed to be contagious. It did not seem "to be a modification of scarlatina, and was very different from "common or idiopathic croup. It generally began on the tonsils, "spread to the velum and uvula, and passed down into the larynx "and trachea. What seemed sloughs on the tonsil and uvula

" were of a most nauseous smell, and hence were looked on as the " results of gangrenous, not of fibrinous inflammation. The " disease was certainly not a local one, but a blood disease."—(Dr. Mackenzie, Glasgow.)

Leatherhead.—Dr. Ferguson recollects that at Leatherhead many years ago there prevailed a very fatal epidemic of diphtheria, chiefly in the workhouse, where nearly thirty deaths were occasioned by it. [From inquiries obligingly made on the subject by Mr. Courtney of Leatherhead, it seems that there is local recollection of a severe epidemic of throat-disease as having prevailed in the autumn of 1818.] Dr. Ferguson has seen isolated cases at various other times.

Dulwich.—Dr. Webster, of Dulwich, published in 1850 (the Institute, vol. i. p. 100) some particulars of six cases, apparently diphtherial, which had occurred in his practice during the years 1824–29, and which he had classed together, " because they all " had in reality an assemblage of similar symptoms, and the com- " mon point of danger was the windpipe." The two first, " which " occurred in April and May 1824, were nearly similar to those " which M. Bretonneau observed, but the disease was then un- " known in this country; the third assumed a mixed character, at " first of common ulcerated sore-throat, then of diphtheritis; the " fourth and sixth cases had all the symptoms of ulcerated sore- " throat; the fifth case was one of ulcerated tonsils as the sequel " of scarlatina."

Birmingham.—In 1836 (see F. Ryland, Treatise on Diseases and Injuries of Larynx and Trachea, London, 1837, pp. 161–175) cases of diphtheria were observed at Birmingham, chiefly in connexion with measles.

June 8th, 1836.—M., æt. 5, seen with measles; died on 11th with diphtheria (faucial and laryngeal), of which there was no appearance when the child was first seen. On the 10th, when last seen by Mr. Ryland, croupy symptoms were advanced, and the eruption of measles was still out. " About the time that this case " occurred many children died of a similar affection of the throat " complicated with measles; but no examination was made of " their bodies after death. They had in most instances cough, " difficulty of swallowing, impeded respiration, hoarseness, ulti- " mately suppression of the voice, and in many cases swelling of " the submaxillary glands." From May 29 to June 9 inclusive, three children died in one family in a court in a narrow street in Birmingham of measles, complicated with diphtheria, and on June 1 a child living next door to them " died of " croup after small-pox." . . . " Cases of a similar nature occurred in " the same district of the town, and within the last two weeks of " the month of May six other children died of the same affection." . . . " Almost all the cases were complicated with measles."

Isolated fatal Cases of Diphtheria recorded as having been subjects of Post-mortem Examination in St. Thomas's Hospital.—J. P., æt. 35, admitted June 29, 1852 (having psoas abscess), died Oct. 15, 1852. " The tonsils were healthy, but the surface of

" the pharynx behind them was covered by a thick, loosely " adherent, white, doughy-looking material. This extended in " large quantities half-way down the œsophagus, and a small " portion of the stomach in the neighbourhood of the cardia " orifice. The mucous surface of the pharynx and upper half of " the œsophagus was extensively ulcerated; that of the lower " half of the œsophagus much congested, and in many places " excoriated. The interior of the upper part of the larynx, " including the vocal chords, was loaded with a similar material, " and the mucous membrane was œdematous and ulcerated. The " deposit appeared microscopically to be made up almost entirely " of epithelium, mixed with fragments of fibrillated material and " some extraneous matters, such as starch, &c. The lower part " of the larynx and trachea were perfectly healthy; the lungs " somewhat conjested. No visceral disease."

" M. A., a servant, aged 22; examined March 24, 1853. The " mucous membrane of the pharynx, fauces, and base of the " tongue was covered by a layer of lymph between half and a " quarter line thick. Its free surface was irregular, fissured, and " in places flocculent. It adhered pretty firmly to, yet could " easily be separated from, the subjacent mucous surface, which " was congested, here and there excoriated, but nowhere distinctly " ulcerated. The lymph ceased gradually at the lower part of " the pharynx, and the œsophagus was healthy throughout. Both " surfaces of the epiglottis and rest of the mucous membrane of " the larynx were similarly enveloped in a layer of adherent " lymph. The deposit extended continuously from the superior " to the inferior chordæ vocales, so as completely to conceal the " orifice of the sacculi laryngis. On removing it, however, a " prolongation from its deep surface was found to extend into the " sacculi, forming a kind of cast of them. As far down as the " true chordæ vocales the lymph was as thick and abundant as " in the pharynx, but below this it was less copiously deposited, " and on the left side almost completely absent, the uncovered " mucous surface, however, being much congested. The mucous " membrane of the trachea was congested, and a patch of lymph, " about one inch and a half long and three-quarters of an inch " wide, continuous with that in the larynx, extended down the " front of the trachea. Two or three smaller patches were " scattered over the upper two-thirds of the trachea. The mucous " and submucous tissue of the upper half of the larynx were much " thickened, the epiglottis measuring a quarter of an inch in thick- " ness, and the calibre of the larynx was considerably dimin- " ished, but quite pervious. The lymph was of a dirty greyish- " brown colour and moderately tough, allowing of being removed " in strips; but its deep surface was considerably tougher than " its free, the latter being, indeed, for the most part pulpy or " shredy. Under the microscope it was found to present an " irregular and indistinct fibrous structure, studded with nucleus- " like bodies, for the most part imperfect and irregular in shape. " Pleura healthy. Lungs of moderate size, but firmer and

"heavier than natural; on section they presented a peculiar "appearance; they were everywhere more congested than "natural, but on close examination presented a curiously mottled "aspect, owing to numerous patches of a dark colour being "scattered uniformly and thickly throughout the substance of "the organs, but separated from one another by a network of "lighter and more healthy looking tissue. The solid patches "were small, about the size of one or two lobules, but running "occasionally into one another; they projected from the cut "surface; had a dark colour, in some as black as that of pul-"monary clot, were granular and solid; yielded on pressure no "fluid, or at most a little bloody serum. They had more the "appearance of apoplectic than of inflammatory formations; "and under the microscope that idea seemed at first borne out "by the vast number of blood corpuscles floating about and "obscuring the tissues. On washing these away, however, the "cells and intercellular passages were found to be filled with "nuclei. In the mass they might have passed for pus; but floating "about the field were many nuclei, which appeared to be of the "same nature, and these were round or oval, as nearly identical "as possible with the nuclei in the cells of the bronchial mucus, "and were unaffected by acetic acid. Moreover, when the air-"cells containing them were acted on by acetic acid, and com-"pressed so as to separate the nuclei, the latter were clearly seen "not to be influenced like pus corpuscles. Yet although many "of the nuclei were like those floating in the field, many were "much smaller in size and less regular in shape. There was a "great tendency in the nuclei to cohere, so that no amount of "pressure availed to squeeze them from the air-cells, or to "separate them completely from one another. The intervening "parts of the lung were of a pale red, yet redder than natural, "and crepitant; owing to the abundance of the solid patches, "the lungs in mass were less crepitant than natural, and more "readily lacerable under the pressure of the finger. The bron-"chial tubes were a little reddened, and contained much frothy "serous fluid. Pericardium and heart healthy."—Dr. BRISTOWE, St. Thomas's Hospital.

Communicability of Diphtheria?—"No case of diphtheria had "ever been seen in Folkestone during my time until Isabella W., "æt. $4\frac{3}{4}$, arrived from Boulogne on the evening of July 2nd, 1856, "being then in an advanced stage of the disease. She died on "the following day. On the 6th July, Cath. W., her sister, "aged 10, was attacked, but she had never been in France, she "had always resided on the East Cliff, Folkestone, in the same "house to which her dying sister was brought 4 days pre-"viously. One other case occurred in the same house 3 days "after, and all terminated fatally."—Mr. EASTES, Folkestone.

"A school-boy convalescing from diphtheria, contracted by "him at Swansea, where it was epidemic, and arriving at home "in an open healthy suburb of Cheltenham, where at the time "there was no diphtheria, was received and embraced by one of "his two sisters. On the 14th day afterwards she was attacked

" by diphtheria and suffered severely. Her sister, who did *not* " meet the brother, helped to nurse *her*, and was attacked in " 14 days after the first sister by the same specific disease with " equal severity. Strict separation from all but mother and " nurse was enforced, with thorough ventilation; and no other " case occurred in the house."—Mr. RUMSEY, Cheltenham.

Concurrence with Small-pox?—1. " Died at Small-pox Hospital " on March 18, 1859, a barman (Bateman), aged 22, from 60, " Castle Street, Oxford Street. Small-pox followed by diph- " theria. The small-pox was confluent upon the face, and semi- " confluent generally. Eruption appeared on Feb. 19, entered " hospital on 23rd. He was nearly well from the small-pox when " he was attacked with difficulty of swallowing and with swelling " about the neck, and died in seven or eight days from the appear- " ance of these symptoms. There was the characteristic exuda- " tion, no loss of voice or laryngeal cough, but some difficulty " of breathing. He got out of bed to the night-stool, fainted, " and died. It is not known whether he had had scarlatina for- " merly. He certainly had no scarlatina rash while in the " hospital. There was no hæmorrhage or purpura. Neither the " nurses who attended him, nor any of his fellow patients had sore- " throat. There had been a boy die of scarlatina on January 8.

" 2. Died at Small-pox Hospital on March 21, Mary Ann Smith, " 20 years, a servant from 6, Old Fish Street Hill. Entered " hospital with small-pox on Feb. 11. Died after forty-four days " from commencement of eruption. It was severe confluent. " She was nearly well from this when the tongue began to swell " and an abscess formed and broke. She continued well for two " or three days, and then tongue and throat externally again " began to swell, and there was difficulty of swallowing but no " exudation. She also got out of bed to the night-stool, fainted, " and died. She had her first throat affection before Bateman had " his. No bleeding or purpura. There was no erysipelas in the " ward. There was no spread of throat disease to nurses or " patients.

" There was a third case, in a man, believed to be diphtheria, " which recovered. A few cases of scarlatina had been in the " hospital from December. Small-pox patients readily take scarla- " tina. A case of small-pox was admitted at the Fever Hospital, " the disease spread to the scarlatina patients there, several were " removed to the Small-pox Hospital, and they in return gave " scarlatina to the small-pox patients."—Mr. MARSON, Small-pox Hospital, London.

Concurrence with Measles?—" On the 12th January of the " present year we were first requested to see several members " of the family of the Rev. M. W., at the Holmwood, near " Dorking, on account of their having measles, an epidemic " of which was prevailing very extensively all round their " neighbourhood. Three or four of the children had the rash of " rubeola out very fully and very well marked, and amongst " these was one, a little girl, in whom the throat affection after- " wards became very severely developed; but it was in the case

" of an infant about a twelvemonth old that the diphtheritic
" disease was first recognised. This infant, on the 15th of
" January, first appeared to be seized with the premonitory
" catarrhal symptoms of measles, with slight swelling of the
" tonsils, which were only at this period examined externally.
" The child continued for the next three or four days to be very
" drooping and poorly, but it was not till the 19th that the tonsils
" were observed to be very much tumefied, and covered, together
" with the soft palate and posterior part of the pharynx, with abun-
" dant thick and tough adventitious deposit. On the following day
" a faint measle-like eruption was observed upon the chest and
" other parts of the body, but certainly not well pronounced
" measles. In spite of all local measures and the abundant intro-
" duction of nourishment and stimulants, in about 48 hours it
" died asphyxiated. The urine was here examined, but gave no
" trace of albumen.

" The little girl about 6 years old, to whose case I just now
" alluded, was at this time lying in a very feeble but feverish and
" irritable condition. The measles in her had been most distinctly
" marked, and had at this day, the 19th Jan., disappeared in
" regular course; but a great deal of sore-throat remained, with
" difficulty of speech and deglutition, but not attended with any
" impediment to respiration. Until the infant's condition had
" aroused our apprehension we had considered the soreness of the
" mouth and throat of this child to be only part of the measles,
" but on careful internal examination it was found that there was
" considerable quantity of yellowish deposit upon the tonsils, not
" so abundant and not so tough and organized apparently as that
" upon the infant's fauces. It was particularly observed that one
" tonsil was more enlarged than the other, and in the course of
" time (for this case was very protracted) the swelling increased in
" the latter as it subsided in the former. This child ultimately
" perfectly recovered under uninterrupted stimulant and sup-
" porting treatment. During her illness a few pustular sores
" made their appearance on various parts of the body, which
" were troublesome to heal.* These were the two most im-
" portant cases. But several other members of the family, six
" or seven in number, (some of whom had previously had measles,
" and were thus exempted from that complication, the others
" being distinctly attacked with the disorder,) were more or less
" affected with sore-throat, enlargement of one or both tonsils,
" with some of the pultaceous exudation upon them. All of
" these got quite well. It is also believed that two of the young
" ladies were subsequently attacked with scarlatina, in one of
" them the epidemic having desquamated in large flakes; the
" other, who having had the sore-throat (without measles) not
" very severely, and had gone away for change of air, returned

* During the convalescence of this child a gland at the angle of the jaw suppurated, as was also the case in an elder daughter of the family, who had been much less seriously affected.

" home, slept with her sister, again left her home, and in about " a week or ten days returned with renewed sore-throat and scar- " latina eruption."—Messrs. CHALDECOTT, Dorking.

Concurrence with Fever?—Dr. Peacock, referring to his public lectures on fever (Med. Times and Gaz. 1854) says, "I have " there twice alluded to diphtheritic exudations on the posterior " fauces and larynx as occasionally complicating typhoid, and I " have referred to that cause as occasioning death in two cases."

Diphtheria affecting accidental wounds?—In the following case the patient was a young gentleman, son of the medical practitioner who gives the particulars:—"The case was one of severe com- " pound fracture of lower third of both bones of leg, tibia pro- " truding; removal of a portion of it before reduction was accom- " plished; did well till the twelfth or fourteenth day; wound " filled with granulations; health pretty good. At this time the " manure in the yard (for he was at a farm-house) was removed " one warm day; next day slight throat affection, with depres- " sion; then the wound became painful and the granulations " covered with the greyish flabby membrane, elevating them much " above the edges of the wound; erysipelas of the leg and sub- " sequently abscess. Treatment by stimulation; and to the wound " acid. nit. fort. After a protracted convalescence he recovered " well, and is now able to walk many miles without lameness."—Mr. STEELE, Reigate.

Eruption in diphtheria?—"I have seen a rash in only one case " of diphtheria, it occurred on the 9th day and disappeared by " the 11th day of the disease. It struck me as being similar to " the roseoloid rash of typhus; there were no petechia, and the " exanthem was confined to the thorax, abdomen, and back. I " have seen no true desquamation."—Mr. RAY, Dulwich.

Urine in diphtheria?—"In every case I have seen, phosphates " were more or less abundant in the urine the first few days. " Albumen may be afterwards detected if daily examined; in " one case it was most abundant, and continued so; in another " it disappeared and recurred after an interval of a week. I have " seen no anasarca accompanying it, and we still are free from " scarlatina."—Mr. RAY, Dulwich.

Impaired vision in sequel of diphtheria?—"The ailment consists " in an inability to adjust the eye to near objects, from weakness, " I suppose, of the ciliary muscle. Of three cases (all boys) now " under my observation, there are two where the patients can " read the smallest type of the postal guide with a low convex " glass; the third can only read large type with this help, but " without a glass cannot read a title-page. Iron is what I should " give them all (good diet of course at the same time), and let " them souse the eyes with cold water night and morning."—Mr. DIXON, London.

Secondary exhaustion?—In the following case the patient was a school-boy, resident with his parents in Camden Town. "The disease " set in with a febrile attack, which lasted forty-eight hours, with " hot skin and rapid pulse (120), soreness of throat, and stiffness of

" neck, but no diphtheritic effusion was observed until the day
" following, when the left tonsil was seen to have several white
" spots upon it, which by the next day had spread into one uniform
" patch over that body. The right tonsil now presented a few
" small spots, and more pain was complained of in swallowing,
" although no real difficulty was experienced. By the evening
" of the second day the fever had subsided, and the pulse fallen
" to its normal standing. On the fifth day the pulse began to fail
" in power, and therefore wine was allowed him, with citrate of
" iron and ammonia. On the 7th there was no increase of mis-
" chief in the throat, but the nostrils began to discharge a serous
" matter, respiration became snoring, and sleep very restless, but
" while awake he breathed gently, and with no difficulty. Sym-
" pathic glands on left side of neck enlarged, pulse 92, no fever.
" On the 9th much the same, but albumen had appeared in the
" urine. 11th day, nostrils discharged less, sleep much less
" troubled. 13th day, diphtheritic patches were becoming de-
" tached; urine contained only a trace of albumen; pulse 92.
" He was cheerful, and amused himself, as he had done for severa
" days, in reading and being read to; but his appetite now began
" to fail, and there was reluctance to take the quantity of wine
" ordered for him (8 oz. daily). 14th day, the false membrane
" had entirely disappeared, as also the albumen in the urine. The
" voice now became nasal, and more pain was experienced in
" deglutition; fluids occasionally passed through the nostrils,
" pulse fell to 80, slept well and composedly. 15th, voice more
" deeply nasal, complained that swallowing gave him pain in the
" ears and head, and of being sick. Beef tea and wine have
" returned several times. Brandy was therefore substituted for
" wine; pulse 72. 16th, passed a comfortable night, but there
" was difficulty in getting him to take anything, was thirsty and
" craved for water, which returned very generally immediately
" after it has been taken, as did food, brandy, and the medicines
" prescribed with the hope of allaying the irritative stomach;
" pulse 60, no fever, no pain. 17th day, everything is rejected
" by the stomach immediately, and alarming attacks of vertigo,
" or swimming of the head, was complained of, accompanied by
" temporary loss of consciousness; pulse 40. Very intermittent
" injections of beef tea and brandy were given every eight hours,
" and sinapisms to the epigastrium were applied; but nothing
" that was done allayed the sickness or kept up the action of the
" heart, which by the 18th day had declined to 32 beats in the
" minute. On the morning of the 19th day it had fallen to 24,
" but on being disturbed to take food or brandy would suddenly
" rise to 70 or 80 per minute. He still maintained a cheerful
" manner when not sick, and would say immediately after the drink
" had returned, 'Now I feel all right;' but now and then, perhaps
" two or three times an hour, the eyes would turn up and he
" would lose consciousness for a moment and recover in a state of
" alarm. In the afternoon he died."—Mr. ADAMS, Harrington Square.

APPENDIX.

No. I.

1860.

Report of the National Vaccine Board to the Rt. Hon. the Lords of Her Majesty's Privy Council.

My Lords, March 10, 1860.

The Board of the National Vaccine Establishment have the honour to report that during the past year 205,366 charges of lymph have been supplied.

The letters of application for lymph received and answered by the Board during the year, amount to 13,541 ; being an excess of 1,123 over those of the preceding year.

8,330 Vaccinations have been performed by the stationary Vaccinators in London connected with the Establishment. This is an excess of 1885 over those performed in 1858. Our correspondents report that 110,145 Vaccinations have been performed by them.

Amongst the various places supplied with lymph during the year, besides hospitals, dispensaries, Poor Law Unions, naval and military depots, militia stations, &c., may be mentioned the following, which are taken in the order in which they stand in the register, viz., Gibraltar, Cape of Good Hope, Lisbon, Barbadoes, Buenos Ayres, Sierra Leone, Gambia, Gold Coast, Malta, Honduras, Hong Kong, Florence, Canada West, Shanghae, Valencia, Almora (Bengal), Newfoundland, Madeira, Malaga, New York, Ceylon, St. Michaels, Wisconsin, Brest, Brazil, Trinidad, St. Kitts, Corfu, Bruges, Berbice, Madrid, Cape de Verde Islands, Prince Edward's Island, Ascension, Montreal, Ottawa, Niger River, Trieste, Sydney, Valetta, Oporto, Genoa, Lima, Jamaica, Hayti, Demerara, Graham's Town, St. Lucia, Antigua.

The recent extraordinary prevalence of smallpox having created great alarm, the applications for lymph reached the unprecedented number of 1,457 in the month of January last. These increased applications required a corresponding exertion on the part of all the officers of the Establishment, and, after a temporary difficulty, the Board was able to find the means of supplyiug the requisite quantity of lymph.

The Privy Council having determined that no future medical practitioners shall be appointed public vaccinators unless they shall have received special instruction in respect of vaccination and the distinctive marks of its success, and having communicated their determination to this Board, the Board has given much time and attention, during the past year, to making such arrangements, in London and elsewhere, as they thought best calculated to aid the Privy Council in efficiently carry-

ing out this important measure. For this purpose some alterations have been made in the London Vaccinating Stations connected with the National Vaccine Establishment, such as will place a station where there will be a competent instructor and a number of vaccinations sufficient for the purposes of instruction within a moderate distance of each of the large metropolitan Medical Schools. Stations also, at which instruction in Vaccination can be properly given have been brought into connection with this Establishment in the following towns in which there are provincial Medical Schools, viz., Birmingham, Bristol, Hull, Liverpool, Manchester, Newcastle-on-Tyne, Oxford, and Sheffield.

In consequence of these arrangements some additional expenses have been incurred, which have rendered necessary an application by the Board for an addition of 300*l.* to the usual annual grant which your Lordships were pleased to sanction in your letter of October 22nd, 1859.

We have the honour to be,

Your Lordship's most obedient servants,

(Signed) Thomas Mayo, President of the Royal College of Physicians,

James Moncrieff Arnott, President of the Royal College of Surgeons.

John Simon, Medical Officer of the Privy Council.

Thomas Alfred Barker, Senior Censor of the Royal College of Physicians.

Clement Hue, Registrar.

No. II.

Office of the Local Board of Health for the District of the Parish of Minster.

Sheerness, February 11th, 1860.

Sir,

I am directed by the Local Board with reference to your letter of 20th December, 1859, and to the accompanying copy of a report, without date, made to the Lords of Her Majesty's most Honourable Privy Council, by Mr. Henry Austin, the Chief Superintending Inspector of the Local Government Act Office, on the condition of Sheerness, and on the means available for its improvement, to submit to the Lords of the Council the following observations on the said report.

The Local Board have carefully gone through Mr. Austin's report, and the several statements therein, and, from inquiries made, are led to believe that Mr. Austin visited Sheerness on two occasions only, and on each visit made but a very short stay, not being more than three or four hours in the town, and therefore that it was next to an impossibility for Mr. Austin to obtain the fullest information on the various points points suggested by Dr. Simon, and on the subjects submitted by him (Mr. Austin) to Her Majesty's Council.

With reference to the general question of the improvement of the Isle of Sheppey and its neighbourhood the Local Board consider that they have nothing to do with that part of the report, and therefore proceed to the statement of Mr. Austin, "That the horrible condition "of Sheerness was imminent, the means for its improvement un- "doubted, and might be put in operation at once, and that ample "powers were available, and had been for the past ten years."

This statement, worded as it is, the Local Board consider calculated greatly to mislead any reader not having a personal knowledge of the facts. The Local Board beg to deny both that the condition of Sheerness is horrible, and that ample powers have been for ten years past available for its improvement: as to the former statement it is only in some parts of the town, where the houses are small, badly built, and packed together as thick as they possibly can be in some of the back streets and alleys, that there are any greater nuisances than might be expected in such densely-populated parts of any town; but as in all other towns the portion inhabited by the poorer part of the population requires constant attention on the part of the Board and the Inspector of Nuisances, and, in the opinion of the Board, receives such attention; and as to the latter allegation, the Local Board beg to assure their lordships that ample powers to effect such improvements as were required, and as the Board were most desirous to carry out have not been available until very recently.

The whole of Sheerness (including all its divisions) is, the Local Board believe, below high-water mark. The observations which follow that statement in Mr. Austin's report appear to be taken from Mr. Ranger's report, made ten years back, which was highly coloured and exaggerated, and a great part totally untrue, but as a very few inhabitants attended Mr. Ranger's Court of Inquiry, and those consisted chiefly of persons desirous of ousting the Commissioners under a Local Act of 10 Geo. 4., the Local Board beg to state that sewers were made by the Commissioners acting under a Local Act of 41 Geo. 3., who preceded the first-named Commissioners, and that such sewers were and are, not merely surface sewers but underground brick-built barrel drains varying from eighteen inches to two feet in diameter, and are and always have been sufficient for the purposes they were made for, and Mr. Austin must have been grossly misled or he could not have stated that the inclination of some of the sewers was the wrong way, and in consequence they were charged with mud, as they have been now constructed nearly thirty-five years, and it has been only once necessary during that period to clean out a portion of them.

With reference to the water supply the towns, until the last two or three years, have, in the opinion of the Local Board, been well supplied with good water; but the Board would have preferred the water being laid on to each house instead of being supplied in the present mode, and consider that the Board of Admiralty, although professing to supply their artificers and labourers with water, so limit the time for obtaining it that great numbers of them cannot get half supplied, and yet the Local Board cannot agree with the assertion that between 2000*l.* and 3000*l.* per annum is paid for water, for they believe from their own observation, and from the statements of persons connected with the wells, that not more than half the sum is paid for water.

With reference to the statement in Mr. Austin's Report, "That the "Local Board, after a very elaborate survey was made by the Ordnance "Survey Department, and plans of drainage and water supply were

"made by Mr. Ranger, the engineer employed by the Board, rejected "those plans as involving unnecessary expense, and another plan by a "local engineer shared the same fate." The Local Board beg to submit that Mr. Austin, from the position he occupies, certainly should not have sent to Her Majesty's Council such unfounded assertions without first taking the trouble to make enquiries of the local authorities as to their truth, for the Board can but refer their lordships to the fact, that they advertised for and received tenders for the carrying out Mr. Ranger's plans, and the lowest tender exceeded the Board's borrowing powers under the Public Health Act, and as to the local engineer's plan, it only existed in Mr. Austin's fertile imagination. The Local Board beg to state that Her Majesty's Government kept those plans, and although the Board tried for years to get them, and made frequent, and persevering applications, the plans were sent back only in July 1859, and yet Mr. Austin, although the department to which he belongs detained these plans in their office for so many years, comes forward to cast the whole blame on this Board as men devoid of feeling, and unwilling to perform the duties they took upon themselves on accepting office, which charge Her Majesty's Council will at once perceive would be more justly made against Mr. Austin and his department.

With reference to the strictures contained in the Report on the Board not having carried out the plan for water works on which they obtained sanction in May 1858, for raising the necessary funds for their execution, the Local Board consider that they acted wisely in deferring those works until they were prepared to proceed with the works for drainage which they had decided on carrying out; but now having all their plans returned from the Government office, and being in other respects in a position to do so, they are proceeding to urge on to completion both the sewerage and water supply, which Mr. Austin justly describes as the two great wants of the district.

With reference to the statement that the drainage, such as it is, has two main outlets, one into the Medway near the pier at Blue Town, where it constitutes a very serious nuisance, the Local Board beg to observe that such statement might lead Her Majesty's Council to believe that this is an open sewer, instead whereof it is a large barrel drain which belongs to the War Department, and receives not only the drainage of Blue Town, but also a large portion of the drainage of the War Department.

The Mile Town Sewer has its outlet into the Fleet, which has been the main outlet since the sewer was constructed, and which Fleet empties itself into the sea through a sea gut belonging to the War Department. That part of Mile Town, which was not sewered, but had only surface drainage into the ditches, (which have always been the boundaries of fences of the different lands, and which now belong to the War Department) has suffered considerably by the act of the War Department filling up these boundary ditches, the original and ancient watercourses, without providing in any manner for the overflow of the surface water. The Board consider the War Department the cause of the nuisances existing at those places, as such nuisances are on their land, and that the War Department were not and are not justified in stopping up the ancient watercourses without providing an equivalent.

With respect to Mr. Austin's observations as to the plans of drainage, the Board will merely observe that in their opinion they are entitled to about as much weight as Mr. Austin's several assertions throughout his report are to credit as to the facts, but the latter part certainly shows

that Mr. Austin can talk of ignorance while he is himself utterly as ignorant of the facts as these plans were in his opinion a striking example of enormous waste by ill judged or ignorant economy.

The Local Board deny Mr. Austin's assertion that the Board have no local surveyor, but are not surprised at it, as Mr. Austin immediately follows this up by saying than an inspector of nuisances was said to exist, but all he could learn of him was that he was never seen in his duties, an assertion quite contrary to the fact, but quite in accordance with the visits and examination of the district by Mr. Austin. The Board, however, are much surprised at Mr. Austin's satisfaction as to the cleansing of the streets, &c., as they consider that, although they do all they possibly can to keep the streets clean, yet that duty is not done so much to their satisfaction as are the duties of the suppression of nuisances.

As to that part of Mr. Austin's report which refers to the improvement alleged by him to be of a partial and interested character, and deserving of special notice only on that account, the Board have to observe that Mr. Austin, having put himself into the hands of some very special and interested persons, has allowed himself to be the medium of reporting to Her Majesty's Council garbled statements not in accordance with the truth.

The Local Board can but believe that the greater part of Mr. Austin's report, particularly the portion beginning with the admission of an improvement, although alleged to be from his own inspection, is nothing more than the adoption of a report made by Mr. Dickens to the Secretary of State on the 26th May, 1859, on the question of separating the upper from the lower division of the district.

The Local Board can hardly believe that Mr. Austin could assert that the Board, being elected by the ratepayers, he could, if they alone suffered, only represent the facts and deplore the apathy or ignorance of the Board and ratepayers, and then state that the present case is different, as the health and comfort of thousands are affected by the state of the town who have no voice whatever in its management, or in the election of the governing body, for if Mr. Austin had only enquired of any person in the town who knew anything of the subject he was sent to Sheerness to inquire into, he would have found that a large majority of the householders are directly represented in the Board, who are elected principally by the workmen in Her Majesty's dockyard, they possessing a great preponderance of votes ; and although it is true that the soldiers in the garrison and the sailors living in the ships do not vote in elections of the Board, yet even they may be considered as represented through the votes of the officers of the war department and admiralty, who, as well as the officers of the dockyard, are entitled to vote in respect of their residences within the district.

The Local Board feel unable to comment upon Mr. Austin's recommendation, to seriously consider whether the ratepayers of a large and populous parish should be disfranchised, inasmuch as the wrong state of things assumed by him as the basis of such recommendation does not exist except (like many others) in Mr. Austin's fertile and inventive imagination ; but if and when such a recommendation from such a gentleman is acted upon by Her Majesty's Council, the Board will be prepared to show cause against it.

The Board do not feel called upon to notice Mr. Austin's opinion as the only efficient and economical plan of drainage, further than to observe, that although they cannot state that Mr. Austin's report deserves

the least credit for being made fairly and truthfully, it has been represented on another occasion that Mr. Ranger admitted that his plans would not have been efficient if they had been carried out. However, as the Board have now invested in Mr. Burns, an experienced engineer, ample powers to deal with the subject, they will leave that part of the question with him.

The Local Board beg to state some of the reasons which have operated to deter them from hastily expending the money of their constituents in carrying out schemes of water supply and drainage. The defects in the drainage of the Government property alluded to by Mr. Austin, which doubtless arose out of mistakes in the construction of their sewers; the difficulties which the local board of Dartford, Croydon, and other places have had to encounter through blindly rushing into schemes of drainage, and the enormous expenses such localities have been compelled to sustain, instead of realizing (as they were led to expect) large profits from the gold mine of town sewage manure, such considerations as these, and not either apathy or ignorance have been the causes of the Board's demurring to spend their own and the ratepayers' money until they were likely to derive some advantage and benefit by the outlay. Now as to the health of Sheerness, and as to Dr. Simon's visit. Although Dr. Simon did visit Sheerness, no report ever came to this Board of the result of his observations except from the Chairman of the Board, who reported that he attended Dr. Simon, and informed him of the Board's efforts to keep the town clean, at which Dr. Simon expressed much surprise, as he had been led to suppose that nothing whatever was done to cleanse the town, and that even no inspector of nuisances had ever been appointed by the Board. But Dr. Simon was referred to the inspector for any information he might require, and the Board believe he did apply to that officer for information. Dr. Simon found that the military at Sheerness were at least as healthy as those at any other garrison town, and it is a fact which can be proved by evidence, that only 13 soldiers had died here during the last three and three quarter years (three of whom were killed by accident incident to the service), although the number of troops stationed here during that period have been about 650 on an average. In the same period only five sailors have died, one of whom was drowned.

Captain Halsted, one of the gentlemen who rendered valuable assistance to Mr. Austin during his inquiries at Sheerness, is a captain in the Navy, commanding the Steam Reserve Guard Ship, and has resided on shore in lodgings during the period he has been at Sheerness. This gentleman has reported to the Admiralty on several occasions the unhealthiness of his crew, and always attributed it to the alleged unhealthy state of the towns instead of to the real cause, the constant coming and going of men from all parts of the world; but the Admiralty finally recommended Captain Halsted to remove the ship to other moorings in the harbour, which no doubt had the desired effect. From the personal appearance of the captain, no one would believe that he had so long breathed a pestiferous air; which latter remark applies equally to Messrs. Linsdale and Blaxland.

In conclusion, the present Local Board rejoice that they are in a position to assert, and do assert, that they are as fully alive to the wants of the district and to the Board's duties and responsibilities, and to their own and their families' lives and comforts, and to the lives and comforts of the families of the working men, their constituents, as Mr. Austin could desire,—combined with a due regard to the properly

spending their constituents' hard-earned money, and having a proper and efficient equivalent for the outlay.

I have the honour to be,
Sir,
Your very obedient Servant,
(Signed) Edward Felkin,
Clerk to the said Local Board of Health.

C. A. Hamilton, Esq.,
Secretary to the Lords of Her Majesty's
Most Honourable Privy Council.

No. III.

Local Government Act Office,
8, Richmond Terrace, Whitehall,
21st March, 1860.

Sir,

I have the honour to acknowledge the receipt of your letter of the 31st ult., enclosing a communication (returned herewith) addressed to you by the Clerk of the Local Board of Sheernees, in reply to my report to the Lords of Her Majesty's most Honourable Privy Council, on the condition of Sheerness, and on the means available for its improvement.

In pursuance of your intimation that their Lordships would be glad to receive any observations which I may think it desirable to make on the Statements of the Local Board, I beg to lay before you the following remarks.

Desiring to be as brief as possible, I will confine myself to those statements which in any way impugn the accuracy of my report, and will pass by the irrelevant and personal remarks in which the Committee of the Local Board have thought fit to indulge, as wholly unworthy of comment.

1st. In order to show that I could not possibly have obtained the fullest information on the various points upon which I was directed to inquire, it is stated that the Board are led to believe that I visited Sheerness on two occasions only, and on each visit stayed not more than three or four hours in the Town. I have only to state on this head, that I was engaged on my inquiries in the Isle of Sheppey during six days, that I devoted many hours each day to inspections of the town and neighbourhood, and visited every portion of Sheerness.

2d. With reference to my statement of the horrible condition of Sheerness, the Local Board deny that the condition of the town is horrible, or that there are any greater nuisances than might be expected in such densely populated parts of any town. They add that the poorer parts of the town receive constant attention from the Inspector of Nuisances, and that I appear to have taken my statement from Mr. Ranger's report made ten years ago.

It is true that I adopted the description contained in Mr. Ranger's report on the state of the town, in order to show that that description was equally applicable at the present day. The Local Board allege that the account was highly coloured and exaggerated, and a great part totally untrue. I must therefore now beg leave to refer to the

report of Mr. Burns, the engineer recently called in by the Local Board. He says, "I never visited a worse drained and filthier town than Sheerness;" and his statements generally with respect to the nuisances which abound in the place, and the culpable neglect of the Board, are couched in far stronger terms than any I had previously used.

This report was received and adopted by the Local Board on the 12th January last, and yet on the 11th February following they write to deny the truth of my more moderate description.

3rd. The Local Board deny also my assertion, that ample powers were available for the improvement of the town, and had been for the last ten years. They state that such powers have not been available until very recently.

The Public Health Act was applied to Sheerness in 1849, and the Local Board might immediately afterwards have commenced the required works of improvement.

Plans were subsequently prepared for complete works of drainage and water-supply in 1853. It is true the tenders for the works did somewhat exceed the rateable value of the district at that time, and this was made the excuse for doing nothing at all. If, on the contrary, the Local Board had at once proceeded to carry out the main, the chief portion of the evils from which the district has ever since suffered would immediately have been removed, and even before those main works would have been complete, it is more than probable that the increase of the rateable value of the district would have enabled the Local Board to borrow money for the execution of the remainder, for between that period and the present time that value has more than doubled.

The Local Board accuse the General Board of Health of detaining those plans of proposed works, for years, in their office, and say therefore that the charge of delay would be more justly made against myself and the department to which I belonged. I beg to state that those plans were never detained in the office of the General Board. They remained in the hands of Mr. Ranger, the engineer, whom the Local Board had employed to prepare them, and Mr. Ranger produced them at the time they are stated to have been received by the Local Board. A set of tracings of the plans which had been deposited at the office of the General Board had been previously returned.

4. With reference to my statement that another plan by a local engineer subsequently shared the same fate as that by Mr. Ranger in being rejected by the Local Board, it is said that such a plan existed only in my fertile imagination, and I am accused of making such unfounded operations as to this, and as to Mr. Ranger's plans, "without taking the trouble to make inquiries of the local authorities as to their truth."

I have only to state in reply that I was first informed of this plan either by Mr. Bryson, the engineer who prepared it, or by Mr. Atkins, a member of the Local Board, at an interview with those gentlemen in London, and that this very plan was subsequently shown to me by Mr. Atkins himself at the office of the Local Board at Sheerness. Mr. Atkins is one of three members of the Board who were deputed to draw up this reply to my report.

5. The Local Board deny my statement that they have no local surveyor, but they do not give the name of the gentleman who fills the office. I can only say that I made several inquiries for such an officer, as I should have been glad to obtain information from him; but I met

with no success, and I must still consider that my assertion was correct notwithstanding this denial, as the annual return made to this Department by the Local Board of the names and salaries of their officers makes no mention whatever of a local surveyor.

6. With reference to my observations as to the partial and interested character of certain proceedings of the Local Board in regard to some works of paving, the Local Board state that I have allowed myself "to be the medium of reporting to Her Majesty's Council garbled statements not in accordance with truth." They do not attempt to say what the truth of the case is, and I need only add that their own minutes will justify the statements I made.

Having now commented upon the main points of the Local Board's reply to my report, I am happy to be able to conclude my letter with the more satisfactory statement that the Local Board have now adopted complete plans for drainage and water supply, prepared by Mr. Burns, an engineer who has exhibited considerable skill in such works at Ely; and the Board now appear desirous of carrying out these works without delay; thus, to some extent, redeeming former neglect. I have examined these plans, and am prepared to report favourably upon them to the Secretary of State for the Home Department.

I have somewhat delayed this letter in order that I might be able to communicate to you for the information of the Lords of the Council, this cheering result, which I believe to be entirely owing to the inquiries directed to be made by their Lordships under the Public Health Act, 1858,—inquiries which have directed public attention to the horrible condition of the place, and have aroused the Local Board to a sense of their duties and responsibilities in respect to it.

I have the honour to be,
Sir,
Your obedient servant,
(Signed) Henry Austin.

No. IV.

Report addressed to the West Ham Board of Health, by Dr. Elliot, the Local Officer of Health.

June 14th, 1859.

Gentlemen,

I beg leave to direct your particular attention to the condition of the River Lea, in that portion of the main stream at Bow Bridge extending from Old Ford Lock to Bromley Lock, and by a cut or continuation behind Meeson's coal wharf and China Row to Marsh Gate Lane, and by another cut on the south side of the Turnpike Road to a dock by Meeson's lime wharf, and Graham's chemical factory.

The area of this water is of great extent.

Having inspected this water on various occasions lately, I have found it in a very foul and offensive condition, black like from town sewage, and the accumulated solid filth fermenting at the bottom of the river was seen to be seething up and raised to the surface by the disengagement of large quantities of foul and fetid gases. This large stagnant pool was quite alive in every part with these seethings, and on the surface in various places was a thick scum of that solid filth. This portion of the main branch of the River Lea, and its upper part near Old Ford Lock, receives all the sewage from the northern district of the metropolis, which flows into it by the Hackney Brook. Before

the year 1850 this branch was partially flushed and scoured by the daily tidal flow and ebb of the stream, and the sewage was thus carried off or largely diluted, and the river was then much more pure than it is now. Since the year 1850, in consequence of new flood gates and alterations then made under sanction of an Act of Parliament, the free tidal flux and reflux in that portion of the river has been obstructed and prevented, the stream has been converted into a stagnant pool, or ditch or canal, with comparative little tidal flow or change, and a great accumulation of filth in the bed of the river has been yearly increasing. In consequence the water has become excessively foul and offensive, and noxious on occasions, at long intervals, when the water has been allowed to run off, and the bed of the river has been exposed, there has been seen a thick deposit of of sewage mud, and the smell from the exhalations has been very offensive. Fishes used to live in this stream, and were taken in large quantities by nets at particular times of the tides; now no fishes can exist in it, and when by chance they deviate into it they are turned belly upwards.

In some parts the banks are covered with inhabited cottages, and these have been habitually the nests of epidemic disease; in particular on the occurrence of the last great outbreak of cholera, the first cases occurred in this district, and the disease raged in China Row and Marsh Gate Lane. At the present time the foulness of that stagnant portion of the Lea is excessive: the exhalations from it are very noxious. During the summer and towards the autumn, according to rise of temperature, it may be expected that this state of matters will become much more dangerous to the public health unless it be remedied. Its tendency will be to predispose to or to cause an outbreak of cholera or fever, or other zymotic disease.

I suggest that, in the first instance, application be made and notice given to the "Trustees of the Lea," requiring them to construct a sewer of proper and sufficient dimensions to carry off the sewage in compliance with the obligations* imposed on them by the "Lea Navigation Improvement Act of 1850," and meanwhile and until such sewer can be constructed to cause the river to be flushed and purified as heretofore by the free admission of the tidal flow upwards and downwards daily.

I am, Gentlemen,
Your obedient servant,
W. Elliot, M.D.E.

No. V.

Mr. Austin's Report to the Lord President of the Council, on the temporary means which may be adopted for Improving the Sanitary Condition of the River Lea.

My Lord,

In accordance with the request of the Lords of the Council, conveyed in Mr. Bathurst's letter of the 30th ult., I had the honour to receive the directions of the Secretary of State for the Home Department to visit the locality of the River Lea, serious complaints having been made of great danger to the health of the neighbourhood from

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* With reference to this point, the company in their reply allege that no such obligation now rests upon them, "the clause in the Act of 1850, imposing such obligation, having been repealed by a subsequent Act passed in 1855."

the very foul condition of that portion of the river which receives the sewage of the Hackney Brook.

Their lordships being already in communication with the Metropolitan Board of Works as to the disinfection of this sewage before its discharge into the river, I am instructed that it is desired to have the opinion of an engineer of this department as to the best means of getting rid of the deposit which accumulates in the river, in order that their lordships may determine what further measures are necessary for the protection of the health of the neighbourhood.

Having conferred with your medical officer, Mr. Simon, I visited the spot on Tuesday last, the 2nd instant, and, in company with Dr. Elliot, the medical officer of the district, examined the portion of the river in question.

Having reason to believe that the representations which had been made as to the very foul and offensive condition of the water were but a few days ago substantially correct, I was much surprised to find the water now in a very different condition. It was of a dirty brown colour certainly, and bubbles were rising here and there from the bed of the river, but little or no offensiveness arose from it. I could scarcely detect any smell from this source throughout the district.

The reason for this remarkable change was soon made manifest. The whole body of water had been changed on Sunday by the opening of the lock gates, and the admission of the tidal water from the Thames.

No permanent improvement of the condition of the River Lea can be obtained until the works now in progress for the interception of the sewage from it are complete. The main source of the evil complained of is, no doubt, the Hackney Brook, but a great amount of sewage is also poured into the river from a large population, and from numerous factories immediately contiguous on both sides; from the West Ham district on the Essex side, and from the Bow district on the Middlesex side. The West Ham Local Board are now making active progress with the works of complete drainage of their district, whereby the entire removal of the sewage from the river will be effected on that side; the sewage from the Hackney Brook and from the Bow District can be intercepted only when the metropolitan main sewer is ready to receive it.

There is, however, every reason to conclude that in the meantime very great improvement in the condition of the river may be accomplished by the Trustees of the Navigation. During every spring-tide the water may be drawn off from the level between Old Ford and Bromley Locks, and the tidal flow of the Thames admitted, (as was done on Sunday last,) apparently without any interruption to the traffic. At these periods, also, if the lock gates on the old river at Old Ford were opened, a considerable flushing power would be obtained above the Hackney Brook outlet, which would have great effect in removing the deposit from the river. It would appear that if notice were given by the trustees at such times to make fast all craft in this part of the river, and other proper precautions were adopted, this flushing operation could be accomplished also without damage, and with little inconvenience. A spring-tide would fill this higher level again to the requisite height.

It may probably be desirable to defer this disturbing operation until the weather becomes cooler, but it would be important during the excessively hot weather that in the lower level between the Old Ford and Bromley Locks the water should be changed not only at spring-tides, but at intervals of every few days, so as to prevent the fermentation which so rapidly sets in at such times.

This intermediate change of the water may occasion some incon-

venience to the navigation, but on the other hand it appears that the evil from which the neighbourhood is now suffering so severely, is in great part due to the alterations made by the trustees a few years ago for the improvement of the navigation. Before these alterations the tide was freely admitted to the portion of the river complained of.

Under these circumstances, I submit that a partial remedy to the evil thus occasioned being within the power of the trustees, no small inconvenience to them should stand in the way of its application.

If these measures be adopted, I believe that the evil will be so far palliated as to allow of waiting, without any great risk or annoyance, until the permanent and complete remedy can be provided.

I observe that the trustees of the River Lea have already consented to an occasional drawing off of the water from the lower level referred to, and that they express an opinion that the free admission of the tidal flow daily, which Dr. Elliott had suggested, is not likely to succeed in remedying the evil while the Thames itself is nearly, or quite as bad. I am inclined to think myself that if, instead of the daily operation, the change were effected only often enough to prevent the general fermentation of the body of water at rest between the locks, it would be better than a daily change, for except when a flushing power can be employed from behind to remove the mud altogether, it is better to disturb it as little as possible.

The engineer of the navigation, Mr. Beardmore, states that during last year, when the Thames was in such a bad state, the water in the Lea was comparatively pure by the tide being shut *out*. This statement would, no doubt, be correct within a certain limit of time, but not after the water of the Lea had been penned up for a long period, as it has recently been in this lower level, receiving the constant addition of sewage from an immense population. The water from the Thames itself, brought to rest in the Lea so as to deposit its offensive matter would, at first, be less offensive that it would be outside where it is kept in a state of agitation. This is the case now in the docks and other places. That the Thames itself is somewhat offensive therefore even so low down the river, is no reason against the proposed frequent change of the water of the Lee. At any rate the remarkable improvement I witnessed on Tuesday is a practical answer to the objection which has been urged against this course.

I beg, therefore, to recommend that application be made to the trustees of the River Lea to the following effect :—

1st. That at every spring tide, until the sewage now discharged into the River Lea can be permanently intercepted, the water between Old Ford and Bromley Locks be drawn off, and the tidal flow of the Thames be admitted in its stead.

2nd. That during each season of hot weather the water of this level be changed, by the same means, at every few days interval between the periods of spring-tide.

3rd. That as soon as the hot weather has ceased, the water from the Old River above the Old Ford Locks be let off from time to time, at periods of spring-tide, for the purpose of flushing away the sewage deposit in the bed of the lower level.

I have the honour to be,
My Lord,
Your most obedient servant,
Henry Austin.

Local Government Act Office,
Whitehall, 4th August, 1859.

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